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DISTILLED WATER.[1]

J. U. LLOYD.

(*Continued from page 196, 1895*).

It was found (see this JOURNAL, 1895, p. 190) that, by means of a stone condenser, ordinary Ohio River water could be employed to make distilled water that would stand the requirements of the U. S. P. concerning organic matter.

Inorganic Matter.—It was also stated that, by means of evaporation in platinum, this water left visible rings of inorganic matter. On determining the amount of this matter, it was found that 100,000 c.c. left 1·8 gm. of residue, which proved to be dissolved stone, and constant. Tucker[2] gives the following limits of observed residues with glass condensers:

100,000 parts of water left from 2·20 to 23·00 parts of residue. In this connection it may be stated that glass, tin, stone and aluminum condensers all leave residues, which, as Prof. T. H. Norton is investigating the subject, will not be considered in detail here.

Keeping Qualities of Distilled Water.—In this direction, the question presenting itself is as to what length of time, under ordinary shop conditions, distilled water may be kept. While it is evident that in securely sealed bottles no change can occur to alter the

[1] The author extends his thanks to Dr. Sigmond Waldbott for assistance in details of this work.

[2] The Adulteration of Drugs. A lecture delivered before the Department of Chemistry of the Brooklyn Institute of Arts and Sciences, May 24, 1895, by Willis G. Tucker.

organic constituents, still, in bottles drawn from in the course of business, the question of increasing organic contamination is pertinent.

March 4th, two 5-pint glass-stoppered bottles were filled with water fresh from the still.

A was closed with the glass stopper, loosely covered with a cap of parchment paper, and was successively tested: March 6th, 7th, 11th, 27th, April 4th, 15th, May 16th, June 12th, August 23d, and December 3d.

Each time, of course, the usual atmosphere replaced the abstracted liquid, but the water stood the test in all instances; in the last examination, the pinkish tint faded considerably upon 10 minutes' boiling, but was still apparent the following day.

B was provided with a cork stopper, having two perforations, through which were inserted a thistle tube containing sulphuric acid, and a siphon tube with stopcock. A plug of absorbent cotton was placed in the funnel of the thistle tube.

This precautionary experiment was probably unnecessary, as shown by the result of *A*; however, the water was tested March 7th, 11th, April 4th, 15th, May 16th, June 12th, and December 4th, without evidence of material change.

It was noticed that the pinkish tint faded less than in the case of *A*, hence, it is manifest that distilled water kept in a bottle protected as before described, deteriorates less than under ordinary precautions.

Another series of tests was made of distilled water kept in smaller bottles, as follows:

March 15th, fourteen glass-stoppered quart bottles, perfectly clean, were filled successively from the still, with water that stood the permanganate test of the U. S. P. A paper cone was inverted over the neck of each bottle, the intention being to examine the bottles successively each month. They were placed on a shelf in the laboratory.

Bottle I was further tested April 15th, May 16th, June 17th, August 23d and December 4th. The last portion stood the permanganate test perfectly, and this notwithstanding the fact that flakes had collected at the bottom of the bottle.

As the first bottle opened gave no evidence of organic change, it might have been deemed unnecessary to disturb all of the fourteen

sample specimens. Still, a few more were opened, as all of them contained a flaky sediment.

The following results were obtained:

II stood the test March 14th, August 23d and December 4th.

III and IV March 14th and December 4th.

V was examined with a view of determining how distilled water would keep in a bottle loosely covered with tissue paper only.

Water, distilled March 4th and contained in a glass-stoppered bottle, stood the test March 14th and June 17th. The stopper being removed, the mouth of the bottle was now loosely covered with tissue paper and the bottle placed on a shelf in the laboratory and tested again August 23d. It stood the test very well, but a sort of scum, resembling a fungus growth, had collected on top of the water. At the date of writing this (December 4th) the quantity of scum has increased, and a sediment has also formed. The clear intermediate liquid, withdrawn by means of a clean pipette, stands the permanganate test very well; but another portion into which some of the large flakes were introduced purposely, was gradually decolorized by ten minutes' boiling. These flakes, however, which appear identical in their nature with those to be found in each of the fourteen closed quart bottles, consist of inorganic material for the most part, but also contain organic matter, as incineration or treatment with sulphuric acid will demonstrate. Whether the inorganic portion of these flakes is only the inorganic matter which is held in solution by the distilled water, or whether they are due partly to some corroding influence exerted by the water upon the substance of the glass, is a point that was not determined in these experiments.

In now comparing the keeping qualities of distilled water, it is manifest, as shown by these experiments, that water remains almost unimpaired with regard to the permanganate test of the U. S. P. during a period of several months, and probably will stand much longer, if the water is contained in quart bottles, even though it be withdrawn in parts at intervals. In larger bottles, say of 5 pints, the water gradually deteriorates during a period of several months if no special precautions are taken to purify the air entering in the place of the water withdrawn from the bottle.

During the examinations it was found that, in the presence of tobacco smoke, and also the vapor of nicotine in the air of the

laboratory, the permanganate test was inoperative, the same being true in the presence of iodine vapors. Upon carrying the same quality of water to localities free from such contaminations, it stood the permanganate reaction, thus showing that the tests should not be made in the presence of certain atmospheric impurities.

From the results of the first series of investigations (see this JOURNAL, 1895, p. 190), it is seen that with suitable apparatus distilled water, to withstand the rigid organic test of the U. S. P., may be obtained direct from ordinary river water. In this connection it may be stated that the same good results have followed with water distilled during the entire season, both in summer and in winter.

Contrary to the preconceived opinion of the writer, no organic disturbance results in such water during the usual time that would be employed in emptying a medium-sized container. Under ordinary conditions, and without special precaution, it can be used for dispensing purposes with confidence.

In applying the permanganate test the condition of the atmosphere might lead to incorrect conclusions concerning the water.

All distilled water encountered to date contains inorganic matter in solution, enough, under the conditions named in this paper, to deposit a sediment in time. This sediment also holds organic matter as an invariable constituent, which it seems difficult to exclude entirely in the making and keeping of the distilled water. Still the amount contained in the latter is so small that it does not perceptibly interfere with the permanganate test.

Conclusion.—(1) It is impractical (by reason of inorganic impurity) to make distilled water in glass, stone or ordinary metal condensers that will stand the pharmacopœial test.

"When 1,000 c.c. of distilled water are evaporated on a water bath to dryness, *no residue* should remain."—U. S. P.

(2) The pharmacopœial test (permanganate) for organic impurities is not too rigid.

(3) Precautions should be given in the Pharmacopœia that the permanganate test be not applied in a very impure atmosphere.

(4) If the neck of the bottle be protected with an inverted paper cap or other cover, and the operator is careful not to touch the lip of the bottle with his hand, the water will retain its purity and the Pharmacopœia can demand that distilled water used for dispensing withstand the present test for organic matter.

SOME OBSERVATIONS REGARDING KOLA NUTS.

By Alfred R. L. Dohme and Hermann Engelhardt.

The kola nut (Cola Acuminata) originally was obtained exclusively from Africa, principally from the country south of Abyssinia, where, too, another caffeine-yielding plant, the well-known coffee bean (Coffea Arabica) is indigenous. As this drug has become so well known and popular recently, and as its properties and a description of its botany, chemistry, pharmacognosy and pharmacology have become generally known among pharmacists, a repetition of these will be unnecessary here. From most parts of Northern Africa considerable quantities are shipped, principally from Sierra Leone, Gambia, Kano and Timbuctoo. The most highly prized varieties are those raised in Kong and the Mandingo lands, although it has been customary to assume that the kola nuts from Jamaica are the most desirable. The Jamaica nuts are unquestionably larger and handsomer in appearance, but it has often been shown that the handsomest and boldest varieties or parts of the plant are not the most valuable medicinally. We know that the virtue of a drug depends upon one or more ingredients, and the criterion, hence, for a medicinally active and desirable drug, is the amount of active ingredient that it contains, as determined by assay. It is, of course, desirable and expedient that the U. S. P. should give processes of assay for all drugs that contain active principles, and then establish a certain percentage of active principle as a standard for each drug. This, it appears to the writers, is one of the foremost problems that should confront and occupy the attention of the Committee on Revision of the U. S. Pharmacopœia. The problem, which is the most desirable variety of kola nut, in so far as it contains the most caffeine, has several times presented itself to the writer, and it was a question if West India kola nuts were actually worth 25 per cent. more than African nuts. It has been pretty well established that all that possesses any value in kola nut is the caffeine, for the analysis of Schlotterbeck and Knox[1] brings to light nothing else that might be considered of value medicinally, for 3 per cent. of tannic acid, 4 of sugar and 35 of starch, can hardly be given any medicinal value. Attfield[2] found that kola nuts contain 2 per cent. caffeine, whereas

[1] *Proc. Amer. Phar. Asso.*, 1895.

[2] Amer. Jour. Pharm., 1865, p. 205, and *Jahresbericht der Pharmacie*, 1865, p. 157.

Heckel and Schlagdenhauffen[3] obtained as much as 2·3 per cent. caffeine, and, besides this, theobromine, 0·023 per cent.; fats, 0·5 per cent.; tannic acid, 1·59 per cent.; starch, 33·7 per cent. Schlotterbeck and Knox obtained practically the same figures as these, but none of these investigators state whether they used West Indian or African kola nuts. Good typical samples of both these varieties of kola nuts in the dry state were procured from reliable sources. The African nuts were not prepossessing in appearance, being smaller and darker than the Jamaica nuts, and more shrivelled and less perfectly cured than these. Two methods of assay were tried in case of each kind of nut, using chloroform in the one and 33⅓ per cent. alcohol in the other, as boiling with pure water was impracticable, on account of the large amount of starch contained in the nuts.

Method I.—This was similar to that employed by Schlotterbeck and Knox, and consisted merely in extracting the powdered nuts in a Soxhlet apparatus until the chloroform runnings no longer yielded a residue, evaporating off the chloroform and evaporating the residue to dryness on a water-bath with calcined magnesia and sand, in a flat porcelain dish. This dry powder was then placed in an Erlenmeyer flask, and boiled with chloroform on a water-bath. It was necessary to put a cork fitted with a small condenser or a long glass tube on the flask, so as to avoid loss of chloroform. After heating to boiling for half an hour, the contents of the flask were allowed to cool, and then filtered into a tared flask. On distilling off all the chloroform, and heating the flask for half an hour on a water-bath at 100° C., it was weighed and the amount of caffeine obtained thus determined. The caffeine obtained was not quite white, but had a light brownish tint.

Method II.—The powdered nuts were boiled in an Erlenmeyer flask with an inverted condenser or long tube attached, on a water-bath for three hours, with a mixture of two parts of water and one part of alcohol by volume. Part of the starch will, of course, be hydrolyzed, but not sufficient to render filtration impossible. The contents of the flask, after cooling, were filtered, and the filtrate evaporated nearly to dryness on a water-bath in a porcelain dish. When nearly to dryness, calcined magnesia and sand were added, and all evaporated to complete dryness, stirring carefully and frequently. The residue

[3] *H. and S.*, "Des Kolas Africains," Paris, 1884, Masson.

was then transferred to an Erlenmeyer flask and exhausted with chloroform and treated just as in case of Method I. The caffeine obtained by Method II was of a pure white color, and was hence purer than that obtained by Method I. Besides this advantage of Method II over Method I, may be mentioned the fact that Method II was much more expeditious and satisfactory, and extracted more caffeine than Method I.

Below are appended the results:

	African Nuts.	Jamaica Nuts.
Method I.—Caffeine	2·04 per cent.	1·75 per cent.
Method II.—Caffeine	2·24 "	1·93 "

These figures would indicate that the African kola nuts are richer in caffeine than the West India nuts, which was not to be expected, considering that the latter are the more expensive; furthermore, they show that the method which uses 33⅓ per cent. alcohol extracts the caffeine more completely than does the method which uses pure chloroform. The extract obtained from the Jamaica nuts was lighter in color than that from the African nuts, and resembled a tea infusion, whereas the extract from the latter resembled an infusion of coffee in color.

BALTIMORE, November 25, 1895.

SPERMACETI.

BY LYMAN F. KEBLER.

Cetaceum forms lustrous, white, semi-translucent masses, with a broad, foliaceous, crystalline structure; somewhat unctuous to the touch, and, when fresh, has a neutral reaction. It is soluble in chloroform, ether, carbon disulphide, boiling alcohol, and fixed and volatile oils. The United States Pharmacopœia requires it to possess a specific gravity "about 0·943, and a fusing point near 50° C."

About two years ago, the writer had occasion to examine several samples of spermaceti, and was much surprised to find that his data of specific gravities and melting points did not correspond with the above authority, while in all other points there was perfect accord. On consulting the various dictionaries and other works of reference on chemistry; it was found that they generally sustained the official guide. After carefully examining the samples for adulterants, with

negative results, and being well aware that this peculiar, concrete, fatty substance was not readily adulterated, as any foreign substance greatly disturbed its physical character, the writer was forced to the conclusion that the samples were genuine. From this time, data were accumulated from various sources.

On carefully comparing the recorded specific gravities, at 15° C., it was observed that they were practically derived from two sources. E. Dieterich,[1] in a tabulated list of specific gravities for a number of fatty bodies, records 0·96 for cetaceum. This has been copied very little, and Mr. Dieterich practically stands alone in his observation. The lower specific gravity, 0·943, is generally credited to C. Schaedler,[2] but it really originated in 1820 with T. Saussure.[3] Mr. A. H. Allen[4] gives 0·942–0·946 as specific gravity. In several instances, 0·945 is given, but no original communication could be found to sustain it.

The melting point of spermaceti received a greater share of attention by the various workers. The reports are as follows: T. Saussure,[3] 47° C.; E. Chevreul,[5] 44° C.; J. Stenhouse,[6] 41·6° C.; T. Wimmel,[7] 44°–44·5° C.; F. Rüdorff,[8] 43·5°–44·3° C. Mr. Wimmel,[9] in his contribution, reports the following observations of melting points by a number of eminent workers: Person, 42·7; Berzelius, 44·7; Liebig, Bolly, 44-45; Chateau, Schubarth, 45; Bunsen, 47·7; Pouillet, Müller, 49; Dulk, 50° C.

Chevreul[10] obtained a body by repeatedly recrystallizing spermaceti from hot alcohol, that possessed a melting point of 49° C. To this substance, in 1814, he applied the name cetine, to differentiate the absolutely pure substance from the commercial article, which fused at 44° C. The following additional melting points for cetine have been observed: Stenhouse,[11] 48·9°-49·4° C., and W.

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[1] 1882, Geschäfts-Ber. v. E. Dieterich; Arch. d. Pharm., (3), 20, 454.
[2] 1883, Die Technologie der Fette u. Oele des Pflanzen- u. Thierreichs, p. 679.
[3] 1820, Ann. Chim. Phys., (2), 13, 340.
[4] Dict. Appl. Chem. (Thorpe), 3, 34.
[5] 1823, Recherches Chemique sur les corps gras d'origine animale, p. 170, 237.
[6] 1842, Phil. Mag., (3), 20, 271; J. prakt. Chem., 27, 253.
[7] 1868, Ann. Pogg., 133, 121.
[8] 1872, Ann. Pogg., 145, 279.
[9] 1868, Ann. Pogg., 133, 135.
[10] 1823, Recherches s. l. corps gras, p. 176.
[11] See reference (6) above.

Heintz,[12] in his classic communications, reports a cetine which he obtained by repeated recrystallizations that melted as high as 55·5° C.

After eliminating the extremely high specific gravity, 0·96, and the high fusing points, 49 and 50° C., which probably represent cetine, there are left the following recorded constants: spermaceti, melting from 41·6 to 47 7° C., and specific gravity, approximating 0 943 at 15° C.; cetine fusing from 48·9 to 55·5° C.

To what extent the above constants agree with those obtained in the course of this investigation, the following table will show:

Number.	Melting Point. Degrees C.	Specific Gravity at 15° C.	Acid Number.	Ether Number.
1	44·5	0·935	5·17	134·6
2	43·5	0·935	2·33	125·8
3	44·5	0·939	1·18	128·9
4	44·5	0·939	1·13	126·2
5	44·0	0 942	0	127·6
6	44·0	0·933	0	126·9
7	45·0	0·920	1·40	126·0
8	46·0	0·933	0	127·4
9	45·0	0·925	0	0
10	47·0	0·925	0·90	127·8
11	45·0	0·915	0·70	129·0
12	45·0	0·920	1·43	132·0
13	46·0	0·925	1·05	128·0
14	47·0	0·930	1·43	131·0
15	45·0	0·905	1·90	128·3
16	43·0	0·925	0	131·6
17	46·0	0·930	0·70	129·0

No. 1 was obtained from Prof. Trimble, being a sample of the specimen in the Museum. It was obtained from New Bedford, and placed in the Museum of this College in 1877. The extremely high acid number indicates old age. No. 2 was furnished by Prof. Stevens, of the University of Michigan; he did not vouch for its purity. No. 3 was kindly sent by Mr. England. It was represented to him to be pure, and it was a very nice article. Nos. 4 to 17, inclusive, represent data obtained from samples taken from 90 cases, representing about 4,700 pounds of spermaceti. All this was procured

[12] 1851, Ann. Pogg., 84. 231; 1852, Ann. Pogg., 87, 21, 267.

directly from New Bedford, Mass. No. 5 represents a sample of spermaceti that was recrystallized twice from absolute alcohol.

The above results will not be a matter of surprise, when we recall that spermaceti, like a number of other animal products, is a mixture of severally fatty bodies. According to Heintz, even cetine is a mixture of cetyl palmitate and esters of stearic, myristic and laurostearic acids.

The melting point was taken as follows: dip the bulb of the thermometer into the sample of melted spermaceti an instant; on removing and cooling, the bulb will be covered with a fine film of the spermaceti. Introduce the thermometer into a large test-tube, through its perforated stopple. The stopple must have a second perforation or other device for equalizing the pressure. The test-tube is now introduced into warm water, the temperature and the film carefully watched, and the instant a hanging drop is formed, the temperature noted and recorded as the melting point.

The specific gravity was determined by diluting alcohol so that the pellets of the spermaceti would float indifferently in it. The specific gravity of the diluted alcohol being identical with that of the floating pellets, it was necessary only to secure the specific gravity of the liquid in the usual manner.

The writer considers the acid and the ether numbers the most reliable constants for spermaceti. Adulterations must be most cleverly adjusted so as not to disturb these constants, and at the same time not destroy the peculiar crystalline structure.

From the above accumulated data, the writer concludes: (1) the melting point of spermaceti varies from 42 to 47° C., while that of cetine varies from 48·9 to 55·5° C.; (2) the specific gravity ranges from 0·905 to 0·945, at 15° C., and does not approximate 0·943 so rigidly as formerly reported; (3) the saponification number ranges from 125·8 to 134·6, while the acid number varies with the age of the sample; and lastly, that the requirements of the Pharmacopœia are those for cetine, and not spermaceti.

305 Cherry Street, Philadelphia.

BEECHNUT OIL.

By Charles H. LaWall.

The American beech tree, Fagus atropunicea, Marshall,[1] Fagus ferruginea, Aiton, natural order Cupuliferæ, has been the subject of much controversy as to whether the variable forms which it assumes have a right to be considered distinct species or merely varieties. Gray's Botany of the Northern United States, 1889, recognizes but one species, Fagus ferruginea. The existence of at least two distinct species was claimed by Michaux[2], who brought forth numerous points of difference, which will be referred to later.

Cut-leaved, weeping and other varieties of beech have been introduced by cultivation. They do not, as a rule, form permanent varieties, but show a tendency to revert to the original species, which, in the cut-leaved variety, is often noticed by a single spray of leaves, going back to the original form.[3] The beech has been the subject of much literature, and, except where direct mention is made of the American beech, the references will be understood to apply to the European beech, Fagus sylvatica.

The name beech is derived from the Anglo-Saxon boc, bece or beoce; German, Buche; Swedish, bok, the words meaning at once a book and a beech tree. The allusion to books is doubtless derived from the knowledge that the ancient Runic tablets were formed of thin boards of beechwood. The origin of the word, according to Prior ("Popular Names of British Plants") is identical with the Sanskrit Boko letters, Bokos writings.[4] The generic name Fagus is the classical Latin name, which is derived from *φάγω*, to eat, in allusion to the esculent nuts.[5]

The beech is a large, stately tree, thriving on sandy or chalky soil, according to some writers, while others claim that it prefers a light loamy soil, mixed with pebbles. It is a handsome tree in all stages of its growth, the graceful spread of the straight, tapering branches

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[1] A change proposed at the meeting of the Botanical Section of the A. A. A. S., 1893.

[2] 1819, North American Sylva, Vol. III.

[3] 1882, F. B. Hough, "Report on Forestry," United States Department Agriculture.

[4] 1890, Encyclopedia Brittannica.

[5] 1889, Gray's "Botany of the Northern United States.

being very characteristic, and the pale, smooth bark affording a pleasing contrast to its neighbors in the forest, and seeming to offer special inducements for the carving of initials and dates, which are rendered both artistic and permanent by Nature after a few years' time, and which often remain legible for half a century.

The power which the beech possesses of holding the ground, where climatic conditions as well as soil are favorable, is probably due to its deep shade hindering or preventing the growth of rivals. The drip from its branches is also said to be more injurious to plants than that from other trees. It sometimes attains a height of 130 feet, and often prospers for several centuries.

Beechwood is scarcely suitable for carpentry, as it does not resist either moisture or atmospheric changes, but it is used largely in cabinet-making, and for a variety of minor purposes. Beechwood is very good fuel, and for making charcoal it is said to be surpassed only by willow. In the destructive distillation of wood, creosote is one of the products, and that prepared from beechwood is given preference by pharmaceutical and medical authorities.

The inflorescence of the beech is of two kinds; the sterile flowers are capitate, clustered on drooping peduncles with deciduous scale-like bracts. The fertile flowers are usually in pairs at the apex of a short peduncle invested by numerous awl-shaped bractlets. The blossoms appear in April or May, with the first leaves, and are often injured by the late frosts; this accounts for the fact that the tree only bears a full crop of fruit at irregular intervals. The leaves are oblong-ovate, taper-pointed, distinctly and often coarsely toothed, and in some districts in continental Europe are gathered before they are injured by the frost, and used for the purpose of filling mattresses, being far superior to straw or chaff in this respect. The fruit is very distinctive in appearance, being a sharply three-sided nut, pyramidal in shape, pointed at the apex and flattened somewhat at the base. The involucre is prickly, coriaceous and splits into four valves, which release the enclosed nutlets, usually two in number.

Michaux[6] states emphatically that there are two distinct species of beech in North America, and the following passages are taken from his article on the beech trees, in the hope that it will be of interest to persons not having access to his admirable work:

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[6] 1819, North American Sylva, Vol. III, page 18.

In North America and in Europe the beech is one of the tallest and most majestic trees of the forest. Two species are found in Canada and the United States, which have hitherto been treated by botanists as varieties; but my own observations confirm the opinions of the inhabitants of the Northern States, who have long considered them as distinct species, and give them the names of white beech and red beech from the color of the wood. In the Middle, Western and Southern States the red beech does not exist, or is very rare, and the other species is known only under the generic name of beech. White beech is common in New Jersey, Pennsylvania and the country east of the mountains. It is insulated in the forests instead of comprising large masses. The heart-wood in this species bears only a small proportion to the sap-wood, and frequently occupies only 3 inches in a trunk 18 inches in diameter. On the banks of the Ohio and in some parts of Kentucky, where the oak is too rare to afford bark enough for tanning, the deficiency is supplied by the beech; the leather made with it is white and serviceable, though avowedly inferior to that prepared from oak bark.

The red beech is almost exclusively confined to the northeastern part of the United States. In Maine, New Hampshire and Vermont it is so abundant as often to constitute extensive forests. The name is derived from the color of the wood, and not of the leaves. It equals the white beech in diameter, but not in height, as it ramifies nearer the earth, and is more numerously divided. The leaves are slightly larger and thicker, and have longer points. The fruit is of the same shape, but only half the size of the white beech fruit. A more important difference exists in the wood; a red beech 15 to 18 inches in diameter consists of from 13 to 14 inches of heart, the inverse of which is found in the white beech.

The fruit, or "mast," as it is collectively termed, was formerly known in Great Britain as buck, and Buckingham County, England, is named from its fame as a beech-growing country; buckwheat also derives its name from the resemblance of its angular seeds to the fruit of the beech tree.

Beechmast is eagerly sought for as food by pheasants, deer and other wild animals; in late autumn, when the ground lies thickly covered with it, pigs and turkeys are allowed to run wild and fatten upon the mast; the flesh of domestic turkeys allowed to forage in this manner is said to closely resemble wild turkey in flavor. The kernels, when dried and ground into meal, yield a flour of which wholesome bread can be baked; when roasted, they form a tolerable substitute for coffee.[7]

A clear, yellow, inodorous oil is expressed from the mast; the percentage yielded seems to have been confused, by some authorities, with the percentage existing in the fruit, and the variation in the

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1876, Waste Products and Undeveloped Substances. P. L. Simmonds.

works of different writers in this respect produces confusion in the minds of persons reviewing the subject. The variation in practice is, no doubt, due to the ripeness of the seeds and the degree of pressure employed.

The oil is one of the best-keeping fatty oils known, remaining free from rancidity for twenty years or longer.[8]

In the reign of George I, of England, a petition was presented, praying letters-patent for making butter from beech nuts. A beech oil company was one of the noted speculations of Queen Anne's reign,[9] and large corporations are now in existence in continental Europe, whose object is the production of the oil.

One very old reference to beech nuts is as follows: "The mast or seeds yield a good oil for lamps, and are a very agreeable food to squirrels, mice and swine. The nuts, when eaten by human persons, occasion giddiness and headache, but when dried and powdered make a wholesome bread. They are sometimes roasted and substituted for coffee. The poor people in Silesia use the expressed oil instead of butter."[10]

The oil is obtained by expression, either hot or cold; after the nuts have been freed from dirt and leaves they are ground with a certain proportion of water to form a paste, which is placed in a canvas bag and submitted to pressure for several hours; the paste is then removed from the press and again ground up with a smaller proportion of water than before, and, after warming slightly, it is submitted to pressure a second time. The cold pressed oil, sometimes called "virgin" oil, is somewhat thin, bright yellow, odorless, and of a mild taste. The specific gravity varies from 0·920 to 0·930, according to different authorities, although the figure most frequently quoted is 0·9225, the earliest mention of which was found in 1838.[11]

At one time beech nuts were supposed to contain a narcotic principle, and the press cake was reputed to have a deleterious effect upon horses or cattle, but was used for feeding hogs and poultry;[12] this principle was made the subject of several investigations and

[8] 1889, Bornemann, Die Fetten Oele.
[9] 1876, Waste Products and Undeveloped Substances. P. L. Simmonds.
[10] 1796, Enclycopædia Britannica.
[11] 1838, Berzelius, Lehrbuch der Chemie, Vol. VI, p. 501.
[12] 1894, National Dispensatory.

was named fagin. The method given for its preparation consisted in making an emulsion of the oil-freed seeds with water and evaporating it to dryness with calcium hydrate;[13] extraction with alcohol and subsequent purification yielded the principle which dissolved in water with a yellow color, and formed crystallizable salts with sulphuric acid. Büchner and Herberger[14] had already investigated the kernels, which had been reported to contain hydrocyanic acid; after a thorough examination they failed to find any hydrocyanic acid, but mentioned the presence of a coniine-like, volatile alkaloid. The presence of this reputed narcotic principle seems to have remained unquestioned for a number of years, until Brandl and Rakowiecki[15] made a thorough investigation of the kernels, which were successively treated with ether, alcohol, cold and warm water and hydrochloric acid. They found, among other substances of minor importance, 45 per cent. of fixed oil, 3 per cent. of starch, albuminoids, gum, resin and a volatile alkaloid. Further examination of the last-named substance led to its identification as trimethylamine. The fatty oil, according to them, consists principally of oleic acid, with a little stearic and palmitic acids, in combination with glycerin. Their conclusions in this respect have been upheld by subsequent investigations.

According to Schaedler[16] the shelled beech nuts contain, in 100 parts: Oil, 21·26; organic substances, 64·12 (including 24·00 parts albuminous matter); ash, 4·12; moisture, 10·50.

The warm pressed oil has a sharp acrid taste, which disappears after standing, and which can be removed by shaking with cold water and subsequent separation. The oil is an excellent burning oil, and is equal to olive oil for culinary purposes. It is sometimes used as an adulterant of almond and olive oils; saponifying easily it yields a whitish soap of soft consistence, which turns yellow and eventually greenish.

In spite of its manifold uses and comparative ease of expression, the demand is always in excess of the supply in regions where it is produced; this is due to the fact, previously mentioned, that the

[13] 1838, Berzelius, Lehrbuch der Chemie, Volume VI, p. 501. 1837, Zanon, Arch. der Pharm., Vol. II, p. 213.

[14] 1836, Büchners Repertorium, 57, p. 57.

[15] 1865, Chem. Centralblatt, 36, p. 143.

[16] 1883, Technologie der Fette und Oele.

trees do not bear a full crop every year, consequently permanent establishments for its production can only be maintained in the vicinity of large forests.

The majority of writers upon the subject of the fatty oils class this among the non-drying oils; Allen, however, places it in the cotton-seed oil group among the semi-drying oils, the latter supposition is confirmed by the author's experience with the oil prepared from American beech nuts, as it possessed unmistakable drying properties. The following experiment was performed to test its drying properties, with the accompanying results. 0·764 gramme were exposed on a watch-glass for ten days, the temperature being raised several times by placing it on the water-bath for an hour; after one day it had gained 0·78 per cent. in weight; after two days, 1·17 per cent., and at the expiration of ten days the gain was 3·79 per cent. After exposing about 25 grammes to the heat of a water-bath for four or five days, the oil acquired the characteristics of a blown oil, possessing an acid reaction and a high specific gravity.

The beech nuts examined by the author were gathered in Sullivan County, Pennsylvania. The beech trees in this particular locality are associated with hemlocks; but as the latter are being cut out for the purpose of supplying the tanneries in the vicinity, the beech already predominate.

The weight of 100 average nuts was 28·60 grammes, containing 10 per cent. of imperfect or worm-eaten nuts. The weight of 100 sound, selected nuts averaged 33·15 grammes. The percentage of weight of the husks in the latter was 36·52, the percentage of kernels being 63·48.

The moisture was determined by drying 5 grammes of the nuts, previously powdered with glass, to a constant weight on a water-bath. The average of three determinations was 6·01 per cent.

The ash was estimated by incinerating a small quantity of the powdered kernels in a platinum crucible, the average of three determinations being 3·27 per cent.

The nitrogen was estimated by the Kjeldahl method. Two grammes of the kernels yielded enough ammonia to neutralize 4·73 c.c. of normal sulphuric acid, corresponding to 4·02 per cent. of nitrogen. This is equivalent to 25·13 per cent. of albuminoids when calculated in the usual manner, using 6·25 as the factor.

Reducing sugar was tested for with negative results; 1·5 grammes

of the powdered kernels were then boiled for some time with diluted hydrochloric acid, with a reflux condenser, to invert the starch which was present. The reducing sugar which resulted from the inversion was estimated volumetrically by means of Fehling's solution, and yielded 3·89 per cent., corresponding to 3·5 per cent. of starch.

Specific Gravity.	Per cent. of oil in unshelled seeds.	Per cent. of oil in kernels.	Saponification number.	Iodine number.	Congealing point Degrees C.	Authority.
0·9225	11–25*	20	—	—	—	1838, Berzelius, Lehrbuch der Chem.
0·9207 (Le Febre)	—	—	—	—	—	1866, Gmelins' Handbuch.
0·9200	18–45*	—	—	—	—	1875, Fehling's Handwörterbuch.
0·9210 to 0·9230	—	—	—	—	—18	1882, Allen, Com'l Org. Anal.
0·9225	12–15	20	—	—	—16·5,—17·5	1883, Schaedler, Tech. der Fette u. Oele.
0·9200	—	—	—	—	—15	1887, Hager, Pharm. Praxis.
	12–15	—	—	—	—	1888, Brannt, Animal and Vegetable Fats and Oils.
0·9200 to 0·922	12–15	20–25	—	109	—17·5	1889, Schmidt, Pharm. Chem.
0·9200 to 0·9225	12–16	—	—	—	—16·5,—17·5	1889, Bornemann, Die Fetten Oele.
0·9225 (Chateau)	—	—	196·25	(Gir'd) 104·4	—17·5	1892, Benedikt, Analyse der Fette.
0·9200 (Souchen)	—	—	—	—	—	1892, Benedikt, Analyse der Fette.
0·9225 (Schübler)	—	—	—	—	—	1892, Benedikt, Analyse der Fette.
0·9205 (Massu)	—	—	—	—	—	1892, Benedikt, Analyse der Fette.
0·9220 (De Negri & Web)	—	—	191·1	111·2	—	1895, Benedikt, Analyse der Fette. Translated by Lewkowitsch.
0·9220	—	—	—	—	—17·5	1892, Prescott, Org. Analysis,
0·9210 to 0·9230	—	22	—	—	—17·5	1894, National Dispensatory.
	27–29	43–45	—	—	—	1895, A. Wright, Oils, Fats, Waxes and Mfg. Products.

*The figures indicated in this manner do not indicate whether the seeds are shelled or unshelled.

The fixed oil was estimated by extraction with pure anhydrous ether in a Soxhlet extraction apparatus; five determinations were made, weighing the residue after each extraction to check the results. The average of the five determinations was 52·84 per cent. of fixed oil. This was in the dried material, and is equivalent to 30·65 per cent. in the average nuts in the unshelled condition. The oil extracted by ether was dried on the water-bath for several days, to a constant weight, and then examined for comparison with the European oil, but its drying properties had caused it to assume characteristics far from normal. It possessed a specific gravity of

0985, an acid number of 23·43, and a saponification number of 229 52.

A small quantity of oil was obtained by cold expression, so that a normal sample could be had for examination. The properties of the oil prepared in this manner corresponded very closely to those reported for the European oil. The expressed oil was of a pale yellow color, mild, nutty taste and neutral reaction. The specific gravity was 0·9216 at 15° C.; the saponification number was 195·02. The saponification numbers were, in all cases, accompanied by blank experiments for correction.

The table on previous page has been prepared, making comparisons of the work of many investigators of the subject.

RHUS POISONING.

By George M. Beringer.

This has been the subject of a number of interesting communications published in the *Garden and Forest.* From a pharmacological standpoint they are valuable and interesting. The present writer, being very susceptible to the influence of this poison, is able, from personal experience, to confirm some of the statements made therein.

J. W. Harshberger[1] considers Rhus toxicodendron as poisonous in all seasons of the year, stating that poisonous effects have been experienced in January. He believes its action, however, to be most severe in August and September.

D. P. Penhallow[2] states that the poisonous principle is more or less common to the entire family, and states that in opening an old "marking nut," Semecarpus anacardium, "I was subjected to the effects of the black, varnish-like latex in the interior, which were those of our common Rhus Toxicodendron." He also reports serious poisoning resulting from stirring and smelling the Japan lacquer made from Rhus vernicifera. He states that "after a few experiences it was always possible to ascertain whenever I came into an atmosphere charged with the poison. This was manifested by a well-defined acid taste in the mouth and a slight somewhat acute

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[1] *Garden and Forest*, June 12, 1895, p. 239.
[2] *Garden and Forest*, September 4, 1895, p. 359.

pain directly between the eyes. These were invariably symptoms of the results to follow." The Japanese employ, as a treatment, the flesh and juices of a fresh giant spider crab, Macrocheira Kæmpferi, applied freely to the parts. He recommends free applications of a solution of sodium hyposulphite, ½ ounce; glycerin, 3 ounces; carbolic acid, 60 drops; water, 10 ounces.

Prof. C. S. Sargent[3] considers that the Rhus Michauxii, a rare shrub of North Carolina and Georgia, is the most poisonous of the North American species of Rhus.

E. G. Lodeman[4] writes of his personal experience, and states that the disease reappeared in his own case in childhood for six years, consecutively, about the same time after being poisoned, and without subsequent exposure to the plants. An attack of typhoid occurred in the seventh year, and he then escaped the disease for several years until, thinking himself exempt from the influence, a part of a leaf was rubbed on the back of the hand, and again for several years the recurrence of the disease at the same period occurred. He reports, as a painful concommitant of ivy poisoning, the appearance of boils after each attack, and the more severe the poisoning the greater the number.

Prof. T. J. Burrill[5] again directs attention to his statement made in 1882, attributing the poisonous properties of Rhus to the action of bacteria, but admits that the particles in the latex of the plant, first mistaken for micrococci, are constituents of the latex. While he admits that proof of the bacterial character of the poisoning must be considered as wanting, the apparent period of incubation and activity of the exudation are thought to be arguments in favor of the bacterial theory of cause.

This writer has evidently overlooked the investigations of Prof. J. M. Maisch, in 1865,[6] which proved conclusively that the poisonous action was due to a peculiar volatile acid, which he named *Toxicodendric acid.* The later arguments advanced in favor of the bacterial origin theory might, with equal force, be applied to such vesicants as cantharides, mustard and croton oil.

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[3] *Garden and Forest*, October 9, 1895, p. 404.
[4] *Garden and Forest*, October 2, 1895, p. 398.
[5] *Garden and Forest*, September 11, 1895, p. 368.
[6] AMERICAN JOURNAL OF PHARMACY, 1866, p. 4.

In April, 1883, the writer was severely poisoned in the Odd Fellows' Cemetery, Philadelphia, by handling some poison-ivy on which the new leaves were just appearing. Although the hands were protected by gloves, and the exposed portions, face and hands, were shortly after washed, nearly the entire surface of the body suffered, the face and eyelids being so swollen as to nearly produce blindness. Following this attack came a series of boils, and for several years afterward, about the same time, there appeared the characteristic eruption and sensations when there had been no contact or exposure to the plant.

By carefully avoiding too close acquaintance with the genus Rhus, I escaped with but very slight punishment for a number of years.

In the early part of May, 1894, unfortunately, while in profuse perspiration, I stopped to take up a few violets for my herbarium, and, in doing so, disturbed some vines and roots of the poison-ivy. This was sufficient, however, as a severe attack of poisoning resulted. During the following months, on merely passing by the plants the effects were experienced in a moderate degree. In September of the same year, passing by some Rhus Toxicodendron in fruit at Haddonfield, N. J., the effects were again experienced, and still later in November, near Merchantville, N. J. I came across the upright variety with fruit well developed and leaves fallen, and face and hands were again poisoned. During the summer and fall of 1894, the acquaintance with Job's torments was again renewed, a series of boils adding again to the discomforts of rhus poisoning.

It is now pretty generally admitted that all parts of the Rhus Toxicodendron are poisonous, and at all seasons of the year. In my own experience I have observed that the dust shaken from the roots is likewise capable of causing the irritation wherever it comes in contact with the skin. It is popularly believed that persons of a blonde complexion are far more susceptible to its influence.

During the past summer, washing the face and hands with solution of hydrogen dioxide has been adopted as a preventive, with apparently good results. Hot soda baths have also appeared to be efficacious in the treatment of the disease, and, for a topical application, I prefer the following lotion :

℞ Sodium sulphite granular	1	drachm.
Glycerin	½	fluid ounce.
Camphor water q. s. ad fac.	4	fluid ounces.

PINUS STROBUS, L.

A CONTRIBUTION TO THE KNOWLEDGE OF SOME NORTH AMERICAN CONIFERÆ.

By Edson S. Bastin and Henry Trimble.

INTRODUCTORY.

It is the intention of the authors to contribute a series of articles on the botany, histology, chemistry and economics of our most important cone-bearers. While a portion of the work will necessarily be compiled, it is proposed that the most of it shall be the results of original research. No attempt will be made, however, to exhaust the subject, but we hope to develop and indicate lines of investigation, to be followed up either by others or by ourselves. Probably no large family of plants in this country has received so little attention at the hands of the microscopist and chemist as this one, and the authors hope, by studying one or more typical species in each genus and publishing the results, to be able to materially add to the knowledge of the whole order. It is possible that a strictly logical order of treatment cannot be followed, on account of the difficulty sometimes experienced in procuring the proper specimens at the right time.

In a few cases, we have specimens of coniferous barks from foreign countries, and we shall digress from the title of the paper far enough to consider them along with their nearest relatives in this country. A few foreign representatives, which, by cultivation for ornamental purposes, have practically become naturalized here, will also be considered in their proper places.

GENERAL CHARACTERS.

The Coniferæ may be described as freely branching trees or shrubs, which resemble most dicotyls in possessing tap-roots, and in having monostelic stems containing radially arranged, open, collateral bundles, separated laterally by medullary rays, and growing in thickness by means of a closed cambium zone. The wood, however, differs from that of nearly all dicotyls and other angiosperms in the absence of proper vessels, consisting chiefly of tracheids, which are prominently marked by bordered pits. The leaves are commonly, though not in all species, evergreen and needle-like, awl-shaped, arcuate or scale-like, rigid, simple-veined and without stipules, and usually also without petioles. The flowers are always destitute of a proper perianth and are very simple in their structure, and always separated into staminate or microsporangiate and pistillate or macrosporangiate kinds. The two kinds are usually borne on the same

individual plant, but sometimes, as in the juniper and yew, they are borne on separate individuals.

The sporangia are commonly borne on sporophylls, but sometimes, as in the macrosporangia of the yew, they are terminal on the branches. The microsporangiate flowers usually consist of numerous microsporophylls, compactly arranged either in whorls or spirals, in a cone-like cluster on a slender axis. The microsporophylls are usually scale-like, short-stalked and somewhat peltate, often with the connective continued beyond the sporangia. Each sporophyll bears, according to the species, from two to as many as eighteen sporangia. The latter mostly dehisce longitudinally. The pollen or microspores are frequently multicellular, sometimes globose, but more commonly provided with an opposite pair of turgid, vesicular appendages, outgrowths from the extine. The pistillate or macrosporangiate flower is also usually a cone, and consists of a number of open carpellary scales imbricated on an elongated axis, and bearing the naked ovules or macrosporangia on their upper surfaces. The number of ovules on each scale varies from one to as many as seven.

The yews are exceptional in the fact that there is no macrosporophyll, but the macrospore is borne on the cup-shaped end of the axis.

The macrosporangium usually has a gaping micropyle, and often also the endostome is prolonged into a styloid tube.

The flowers are always wind pollinated.

The fruit is most commonly a dry strobile, but is sometimes a drupe-like or a berry-like galbulus.

The seed is often winged, is always albuminous and the albumin may be oily, fleshy, fleshy-farinaceous, horny, or rarely ruminate. The embryo is straight and axile, the cotyledons, which in different species may vary from two to fifteen, are always whorled and equal, and the germination is nearly always epigæal.

CLASSIFICATION AND DISTRIBUTION.

The order includes, about 350 species, grouped into two sub-orders, the *Pinoideæ* and the *Taxoideæ*.

SUB-ORDER I.

The Pinoideæ include by far the greater number of species. They are the true cone-bearers, the pistillate flowers being cones and

developing into dry strobile-fruits. The seeds have a woody or leathery testa, no aril are attached until ripe to the upper surface of the macrosporophylls or to the placental scales borne by them, and are dispersed by the wind after the scales have diverged to set them free.

The sub-order is divided in the following families:

FAMILY 1.—*The Araucarieæ*, mostly southern hemisphere trees of pine-like aspect. They are characterized by dicœcism, by wingless pollen-grains, and by simple one-seeded fruit scales. Here belong the genera Dammara (Dammar trees) and Araucaria. Four species are well known, Dammara australis, Araucaria brasiliana, A. imbricata, and A. excelsa.

FAMILY 2.—*The Abietineæ*.—These are mostly natives of the temperate and colder portions of the northern hemisphere. They are characterized by cone-scales which are not simple, but double; that is, on the upper surface of one scale, near its base, is borne another, usually a larger one, called the placental scale. To this, near its base, are attached two ovules, each with its micropyle pointing toward the base of the scale. The species are all monœcious. Their pollen grains bear an opposite pair of bladdery expansions, outgrowths of the extine.

The following are the genera:

(*a*) *Abies, the Silver Firs.*—Their branches are whorled and there are no dwarf shoots. Their foliage leaves are flattened and marked on the dorsal surface with two parallel white lines. The fruit is an erect cone, bearing flat placental scales; it matures in one year from pollination, and the scales fall away from the axis to shed the seeds when ripe. The two kinds of scales are nearly equal.

Here belong A. balsamea and A. Fraseri (the balsam firs), A. pectinata (the silver fir), A. Pinsapo, from Spain, A. Nordmannia, from the Caucasus, A. cephalonica, from southeastern Europe, A. amabilis, A. magnifica, and other species from western America.

(*b*) *Picea, the Spruces or Spruce-Firs.*—The species differ from those of Abies in having four-angled foliage leaves which are decurrent, and form ridges on the branches; in having pendant fruit-cones, which fall entire when ripe, and in having the placental scales much larger than the microsporophylls. The leaves possess two lateral resin ducts. The following are examples: P. excelsa (Norway spruce), P. alba (white spruce), P. nigra (black spruce), and P. pungens (blue spruce). The last three are North American species.

(*c*) *Tsuga, the Hemlocks, or Hemlock Spruces.*—These have flat foliage leaves, which are whitened beneath, and disposed horizontally in two rows. The midrib stands out prominently on the lower surface, and is correspondingly depressed on the upper. The staminate flowers in nearly globose clusters; the pollen-sacs dehiscing transversely. The fertile cones mature the first year, are pendulous on the branches, and the scales are thin and persistent. T. Canadensis is our Eastern hemlock, whose bark is so much employed in tanning. T. Mertensiana and T. Pattoniana are West American species, and T. Sieboldii is a Japan species.

(*d*) *Pseudotsuga, the False Hemlock Spruces.*—Leaves flattened, short-petoliate; macrosporangiate scales much longer than the placental ones, thin and three parted; microsporangiate flowers large, and borne in the axils of last year's leaves; flower and leaf-buds very large.

P. taxifolia (the Douglass spruce), and P. macrocarpa (the big-cone spruce) are both West American.

(*e*) *Larix, the Larches.*—The members of this genus differ from all the preceding Abietineæ, in having both long and short shoots, on which the leaves are borne; leaves on the short shoots fasciculately arranged, and on the long shoots spirally, deciduous in the autumn; branches not whorled; both staminate and pistillate flowers terminal on short leafy shoots; cones pendent and maturing in one season. Examples are: L. Americana (the American larch or tamarack), L. Europæa (the European larch, commonly cultivated), L. occidentalis and L. Lyellii, West American species.

(*f*) *Cedrus, the True Cedars.*—They have the general aspect of the larches, but have evergreen leaves, and require two years to develop their seeds. The cones are large, erect and depressed at the ends. There are three species, all oriental: C. Libani, C. Atlantica and C. Deodara.

(*g*) *Pinus, the Pines.*—The leaves needle-like, evergreen, in fascicles of from two to five, with a basal sheath composed of scales; branches falsely whorled; the microsporangiate scales compactly arranged in cones and taking the place of dwarf shoots at the base of a long shoot of the same season; the conical, globose, oblong or cylindrical fruit cones ripening in two years, and bearing thick, usually woody, placental scales, which are expanded at their free ends into a flattish surface or apophysis.

In all, seventy-seven species are known. These are grouped into two sub-genera, that of *Strobus*, or soft-wood pines, and that of *Pinaster*, the hard-wood or pitch pines.

In the sub-genus Strobus the leaves are usually in fascicles of five, the sheaths are loose and deciduous, with an apophysis that is thin and with the umbo at its upper end devoid of a spine. Resin ducts in both wood and bark, but the resin less abundant than in the members of the other sub-genus. Here belong P. Strobus (our white pine), P. excelsa (Himalayan), P. Cembra (stone pine of eastern Europe and northern Asia), P. parviflora, of Japan, and P. Lambertiana, P. monticola, P. flexilis and P. albicaulis, all West American species.

In the sub-genus Pinaster the leaves are mostly in twos or threes, but sometimes in fives, the apophysis is thickened and bears a dorsal ridge, and the umbo is usually terminated by a spine or prickle, the sheaths also are more persistent. The wood is harder, darker colored and more resinous.

Examples are: P. sylvestris (Scotch pine), P. Pinaster, P. Laricio, P. Montana, P. Pinea—all European; P. Taeda, P. Banksiana, P. pungens, P. inops, P. rigida, P. mitis, P. resinosa and P. palustris, of the Eastern United States; and P. Balfouriana, P. aristata, P. monophylla, P. edulis, P. Parryana, P. cembroides, P. contorta, P. Murrayana, P. ponderosa, P. Jeffreyi, P. latifolia, P. Apacheca, P. Torreyana, P. Coulteri, P. Sabiniana, P. radiata, P. attenuata, P. muricata and P. Chihuahuana—all West American species.

Family 3.—*The Taxodiniæ, the Taxodiads.*—Trees of large size; monœcious; leaves scale-like or linear, arranged in spirals; microsporophylls bearing from two to eight sporangia; possessing placental as well as macrosporophyll scales; cones globular or oblong, woody, maturing in one season.

There are several genera, including the Sequoia, of California; Sciadopitys and Cryptomeria, of Japan; Cunninghamia, of China, and Arthrotaxis, of Tasmania—all of which are evergreens; and Taxodium (including the bald cypress of the Southern States) and Glyptostrobus, native to southern China—both of which are deciduous leaved.

Family 4.—*The Cupressineæ, the Cypresses.*—Wood more or less pungently aromatic; leaves small and scale-like or awl-shaped, always in whorls, the leaves and cone scales either opposite or in

threes. Most of the species monœcious, but a few diœcious; the fruits, except in the genus Cupressus, requiring but one year to mature.

They are mostly trees of slow growth, many of them natives of Asia and Australia.

Thuya (Arbor-vitæ), Libocedrus, Chamæcyparis, Cupressus and Juniperus, each have their representatives in the United States; while Thuyopsis, Biota, Actinostrobus, Callitris and Fitzroya are oriental genera.

The Junipers differ from the other members of the group, in the fact that they are diœcious, and in the fact that the fruits are fleshy and berry-like or drupaceous, because the cone-scales become coalescent and succulent in the process of ripening.

SUB-ORDER II.

THE TAXACEÆ.—*The Yews and their Congeners.*—Macrosporangiate flowers not commonly cones. The macrosporophylls either absent or rudimentary, or at least less developed than in members of sub-order I; the seed usually projecting beyond the macrosporophyll, when the latter is present and partly enclosed in a succulent arillus. The flowers are diœcious, and the leaves are evergreen.

The great majority of the group, which number, about ninety species, are Old World or southern hemisphere forms. Taxus Canadensis, T. brevifolia and Torreya Californicum are the American species.

Salisburia, Cephalotaxus, Microcachrys, Podocarpus, Dacrydium, and Saxegothea are other genera, mostly belonging to the Old World.

CHEMICAL COMPOSITION.

The constituents of the plants in this natural order have been but imperfectly studied. Volatile oils, resins, tannin and coniferin are the best known, and all but the last were known and used for their economic value long before any investigation was made of their chemical properties. In the old world, where the oleoresinous products have been used from time immemorial, comparatively little has been done to establish their true chemical composition. It is only in recent years that the terpenes have been successfully investigated. A large number of less important compounds have been noted in the conifers of the Old

World, notably small quantities of organic acids. No doubt, these same compounds will be found more or less widely distributed in the representatives of the order growing in this country. Resin appears to be especially abundant in the pines, and as turpentine, and its two products, oil of turpentine and rosin, it is the basis of one of the largest industries in America. Only a few species, however, yield the so-called gum in paying quantities—in North America it is chiefly Pinus palustris, and in Europe Pinus sylvestris and P. Laricio, which are the chief sources. At least one species, Pinus Lambertiana, exudes a substance which, in physical properties, resembles the sugars.

Abies balsamea yields the well-known Canada balsam, or balsam of fir, and Venice turpentine is obtained from the European larch—Larix Europæa.

Burgundy pitch is another product of the cone-bearers. The Pharmacopœia directs the use of that from the European Abies excelsa. Tar is a product from many species in both continents; in this country it is usually obtained by the destructive distillation of Pinus palustris. Chemically considered, all of the foregoing resinous and oleoresinous substances are made up of a number of compounds.

Tannin is found in the bark of nearly all the members of the order, but only that from a few species is of industrial importance. In Europe a tanning extract is made from the bark of a number of the larches, while in this country Tsuga Canadensis furnishes a creditable proportion of all the material used.

In the bark of many of the species considerable proportions of mucilage exist, sufficient in some of the firs to cause the infusion of their barks to become viscid.

ECONOMICS.

The Coniferæ must rank among the most useful of the natural orders of plants. In the production of food materials, they are, of course, far outranked by the Graminaceæ and by some other natural orders, though several species of the genus Pinus produce great quantities of edible seeds that have been much used for food by the Indians of Western America, and are beginning to be better appreciated by the whites. In the yield of valuable timber, however, the Coniferæ easily stand first. Within the order, the genus Pinus is, for this form of production, much the most important. This is due to the vast numbers and the size of the trees, and to the workable

quality and the durability of their timber. But of great value, also, are the sequoias, especially sempervirens, the junipers, thuyas, cedars, chamæcyparids, spruces, firs, hemlocks, podocarpids and yews. Some, as Juniperus Virginiana and Taxus baccata, furnish timbers of exceeding durability. The species of Abies furnish wood which is most valuable for the manufacture of wood pulp. The bark of the hemlock spruces is of immense value in the tanning industry, and it is not improbable that other species of Coniferæ may prove quite as useful in the same way, when sufficiently investigated. The order is also the most important of all the natural orders of plants, in its yield of resinous and oleoresinous products. Burgundy pitch, Canada pitch, balsam of fir, Venice turpentine, ordinary turpentine, rosin, oil of turpentine, retinol, fir wool oil, oil of savin, oil of juniper, tar, and several other valuable products being obtained from the order.

PINUS STROBUS, L.

WHITE PINE, WEYMOUTH PINE.

GENERAL CHARACTERS.

In this paper *Pinus Strobus*, Linné, has been studied as the type of the soft-wood section of the genus to which it belongs. It is the principal timber pine in the great pine regions of the Northern United States, from Minnesota eastward to the coast, and in Canada. It is a straight-boled tree, and under favorable conditions attains a height of 175 feet, and a trunk diameter, at the distance of 4 feet from the ground, of 5 feet. Its leaves, in fascicles of five, are very slender, about 3 inches long, with two flat and one convex side, on each of the flat sides are two, or sometimes three, whitish lines on the otherwise deep green surface, the lines running lengthwise and parallel to each other from base to apex of the leaf. They are the rows of stomata, the latter being confined to the two flat surfaces. The two angles formed by the convex surface with the flat ones are roughened by minute distant serrulations.

The staminate flowers are one-third of an inch, or a little more in length, subtended by six to eight involucral scales at the base; the fertile flowers are cylindrical and on rather long peduncles; the fruiting cone is pendant, cylindrical, or often somewhat curved, and frequently 6 inches in length, but averages nearer 5; its scales are but slightly thickened at the apophysis and are smooth.

The branches and younger portions of the trunk are smooth-barked, the wood is light, soft and easily worked, being less resinous than that of most other species of its genus.

MICROSCOPICAL STRUCTURE.

Sections of the stems of various ages, of roots showing two or three rings of growth, and of the leaves, were made and tested in various ways.

Sections of twigs of various ages were tested for tannic matters, the following reagents being employed on different sections: Aqueous solution of ammonio-ferric alum, solution of ammonium molybdate, solution of potassium bichromate, solution of osmic acid, and solution of anhydrous ferric chloride in absolute alcohol. The latter reagent was chiefly relied upon, the other tests being used as confirmatory.

It was found that the tannin is of the variety that gives a green precipitate with ferric solutions; although the freshly cut sections showed a blue-black color, due to some accompanying compound. It pervades the protoplasm (1) in many cells of the cambium zone; (2) in numerous large, parenchymatous cells of the bast layer; (3) in numerous parenchymatous cells throughout the cortex; (4) in the two or three circles of granular cells surrounding the resin ducts in the cortex; (5) in many of the collenchyma cells beneath the periderm; (6) in many cells of the phellogen and young cork, and, accompanied by coloring matters, in many of the mature cells of the periderm; (7) it also occurs in many of the parenchyma cells of the pith; (8) the younger tracheids next the cambium zone contain a little; (9) some of the medullary ray cells of the xylem contain a little; and (10) there is a little, also, in some of the secreting cells surrounding the resin ducts in the xylem. As a whole, though, the xylem tissues contain but a small proportion of tannin as compared with the tissues exterior to the cambium zone. Studies of older stems gave like results.

Similar results were obtained from the study of sections of the root, except that it was found that the root is relatively richer in tannin. More was found in the medullary rays in the xylem, and more in the secretion cells about the resin ducts in the xylem, than in the stem; but here, as in the stem, the xylem tissues contain little as compared with the bark.

The distribution of tannin in the leaves was also studied, with the

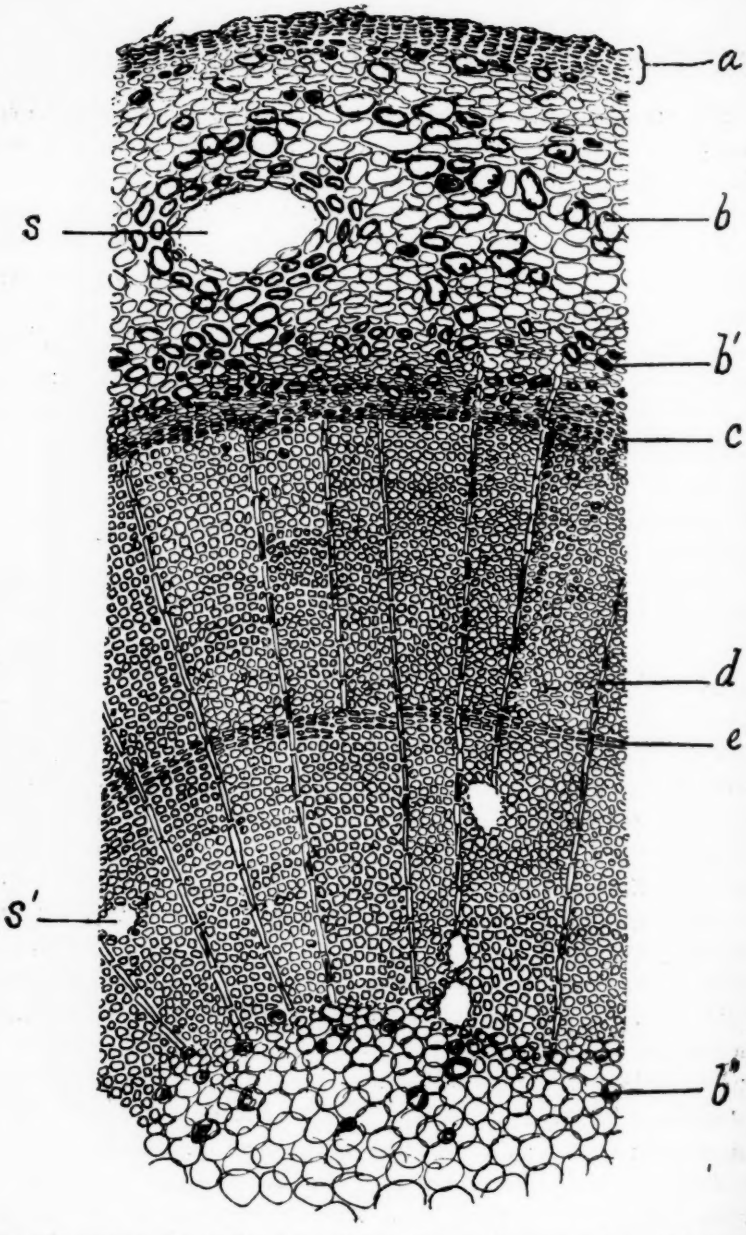

Fig. 1, cross-section of the stem of Pinus Strobus (two years' growth), showing the distribution of tannin. Section drawn as it appears after applying solution of anhydrous ferric chloride in absolute alcohol. The cells shaded dark are those which contain tannin. Magnification, 100 diameters; *a*, periderm (cells mostly containing tannin and coloring matter); *b*, tannin cell in cortex; *b'*, *b''* other tannin cells; *c*, cambium zone containing many cells rich in tannin; *d*, medullary ray, showing tannin in some of its cells; *e*, ring of growth; *s*, secretion reservoir in cortex; *s'*, secretion reservoir in xylem.

following results: tannin occurs in large quantity in many of the mesophyll (folded parenchyma) cells, in smaller quantity in most of the other cells of the same tissue, and apparently not at all in a few of them. In the endodermis and pericycle tissue (transfusion tissue),

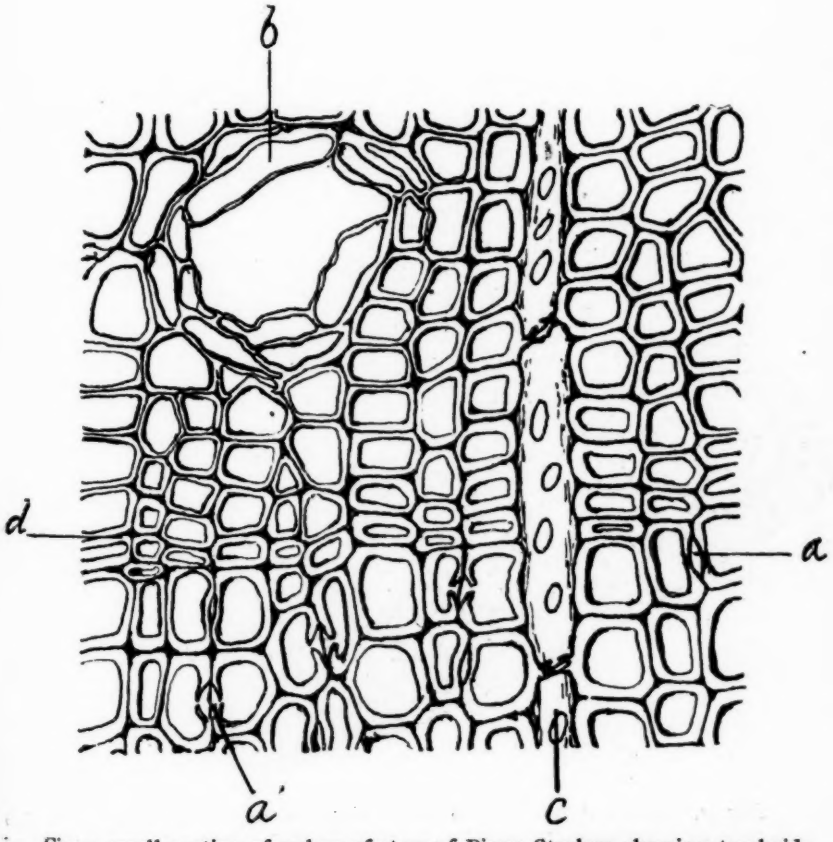

Fig. 2, small portion of xylem of stem of Pinus Strobus, showing tracheids and a secretion reservoir in xylem; *a*, *a'*, bordered pits; *b*, a secreting cell bordering a secretion reservoir; *c*, medullary ray composed of radially elongated cells; *d*, ring of growth. Magnification, 500 diameters.

little or none was observed, but in the phloem and other soft tissues within the pericycle, it occurred in abundance in the protoplasm.

It should be stated that all of the tests for tannin were made upon fresh sections cut from the living plant, and that the test solution was applied to the sections immediately after cutting them. The

results obtained must, therefore, represent, with a fair degree of acccuracy the distribution of tannin in the living tissues.

Both the bast and cortical regions of the stem abound in cells containing mucilage. These cells are usually larger in transverse

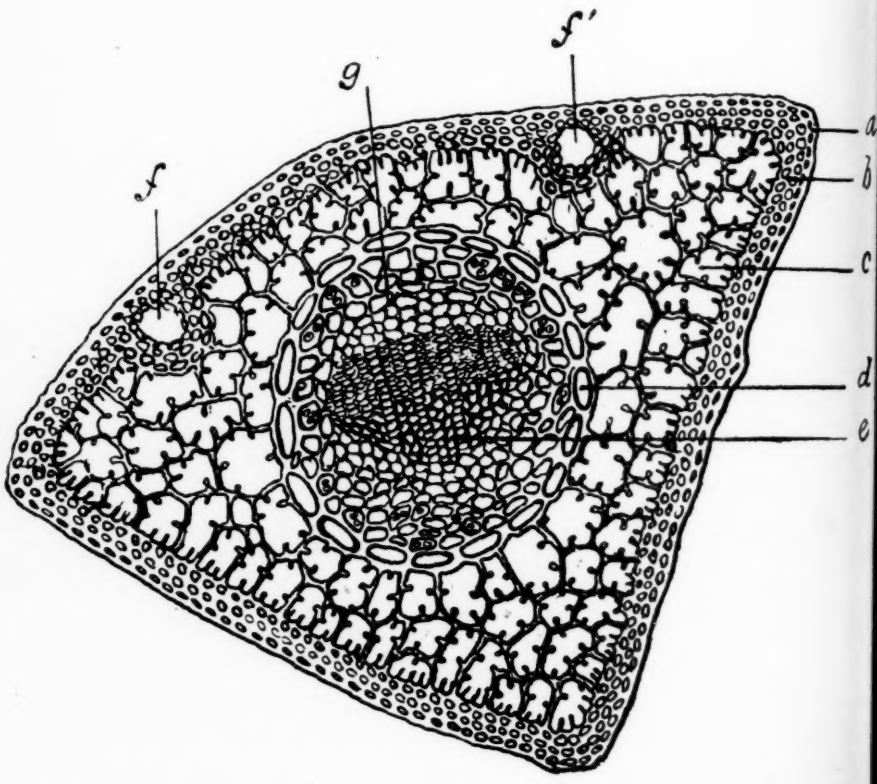

Fig. 3, cross-section of leaf of Pinus Strobus magnified 150 diameters; *a*, epidermis, composed of very thick-walled, lignified and cutinized cells; *b*, hypoderma, composed of lignified and thick-walled fibres; *c*, mesophyll cell, showing folds in the cell wall; *d*, endodermis, enclosing a single collateral bundle; *e*, xylem of the bundle; *f*, *f'*, secretion reservoirs; *g*, pericycle, consisting of numerous thin-walled and short tracheids containing pits in their walls similar to those in the walls of the tracheids of the stem and root (the so-called "transfusion tissue").

view than the cells with which they are associated. Most of them also contain tannin, and many of them oleoresinous matter besides.

The alkannin test showed that oleoresin is not confined, by any means, to the secretion reservoirs, or to the two or three circles of cells immediately surrounding them, but occurs also in many of the parenchymatous cells of the cortex and bast layer, in the medullary-ray cells that cross the xylem, in a few of the tracheids of the xylem, and in many of the parenchyma cells of the pith.

Considering the xylem cylinder as a whole, however, it contains far less oleoresinous matter than the tissues exterior to the cambium zone.

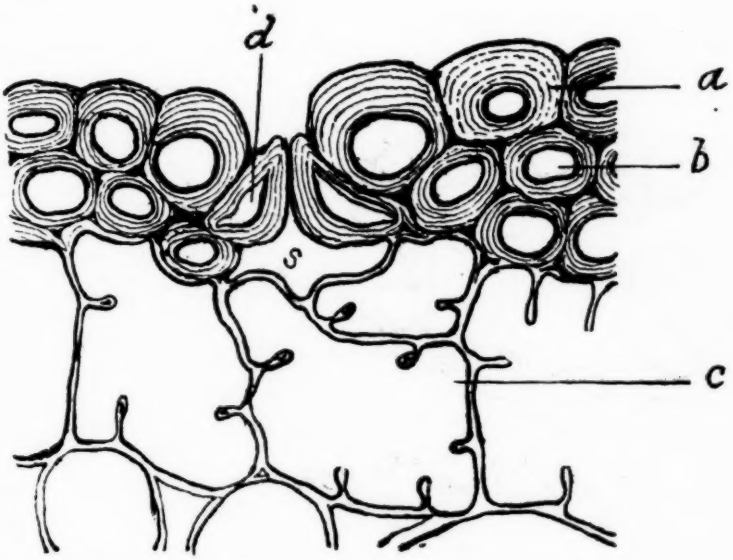

Fig. 4, small portion of cross-section of leaf of same species, magnified 750 diameters to show stoma; *a*, epidermal cell; *b*, hypodermal fibre; *c*, one of the mesophyll cells, deprived of its granular contents by bleaching solution; *d*, one of the guard cells of a stoma. The sections from which *Figs. 3* and *4* were drawn had been treated with Labarraque's solution to remove the cell contents, and afterwards stained.

A few of the large parenchymatous cells of the cortex were observed to contain crystals. In some instances a single cell would contain great numbers of them, but the crystals themselves were not coherent or massed. No sphere crystals, in fact, were observed. As the crystals slowly disappeared without effervescence when the sections were treated with hydrochloric acid, the conclusion was that they are composed of calcium oxalate.

The starch found was mainly in the cells of the cortex or middle bark. The granules were small and of various shapes, some nearly spherical, others much elongated, ellipsoidal, club-shaped, variously bent, angular, etc. Bi-nucleated or double grains are not infrequent, but the majority are simple. The hilum was usually recognizable, and then appeared as a faint central or sub-central dot, or sometimes as a slight fissure, but no other markings were observed.

The root, when young, has three or four xylem rays within its endodermis, but later on, after secondary changes are well advanced, its histology closely resembles that of the stem, save in the absence of a pith.

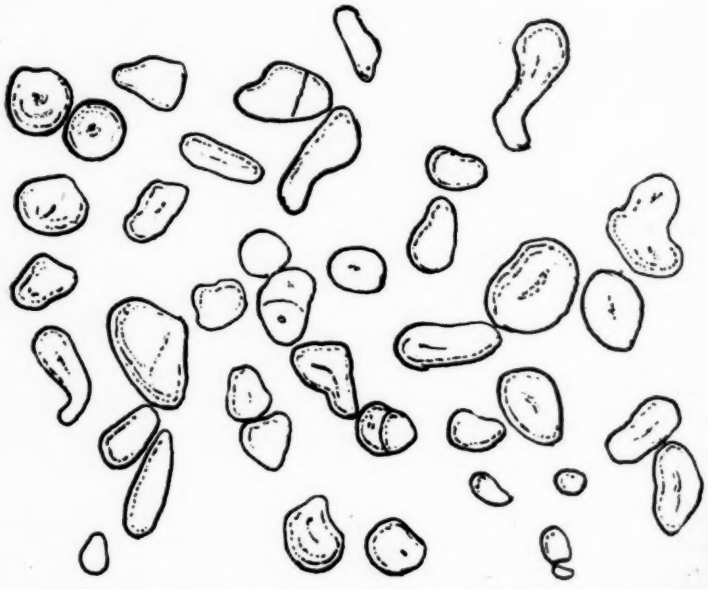

Fig. 5, starch from the root of Pinus Strobus, magnified 1,200 diameters.

The figures, with the descriptions which accompany them, will convey an idea of the essential features in the histology of the stem and leaves.[1]

A study of sections of the stem of *Pinus excelsa*, Wall, showed a

[1] *Authorities consulted.*—John Crombie Brown's Monograph on the Pines. Murray's Pines and Firs of Japan. Baillon's Dictionaire de Botanique. Lambert's Work on the Pines. Warming and Potter's Systematic Botany. Vines' Text-Book of Botany. Brewer and Watson's Botany of California. Gray's Manual of Botany. Lemmon's Hand-Book of West-American Cone-Bearers.

structure very similar to that of Pinus strobus, and a similar distribution of tannic matters. The tannin was also of the same variety and apparently about the same in quantity. The leaves and roots were not examined.

CHEMICAL COMPOSITION.

Proximate Analysis of the Leaves.—When treated with absolute alcohol, the fresh leaves readily yielded their green coloring matter to this solvent, which also removed the acid principle to which their

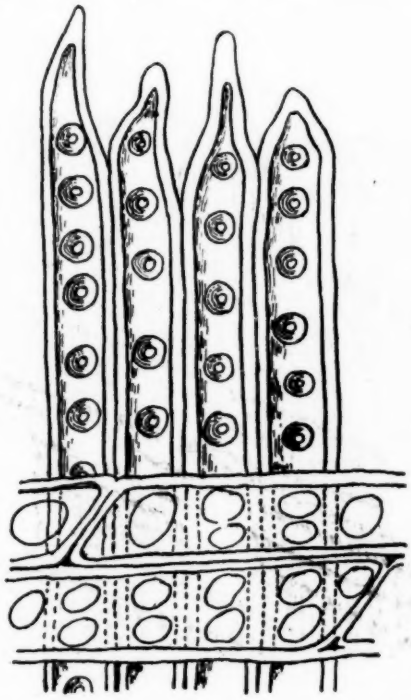

Fig. 6, small portion of longitudinal-radial section through the xylem of the stem, showing portions of four pitted tracheids and some medullary ray cells magnified 400 diameters.

As in most gymnosperms, the bordered pits are mostly confined to the radial walls of the tracheids.

sour taste is due. The total amount removed by absolute alcohol was 18·83 per cent. When this extract was treated with water, an amount of it equal to 8·74 per cent. of the leaves was dissolved. This aqueous solution had a strongly acid reaction, and gave pre-

cipitates with lead acetate, ferric chloride and bromine water; the last two reagents indicated a tannin like that found in oak bark.

That part of the absolute alcohol extract which remained undissolved by water was thoroughly dried and afterwards treated with petroleum ether, which dissolved the greater portion of the material. The small amount which was insoluble in the last-named solvent was of a brown color, and showed a decidedly gritty feel

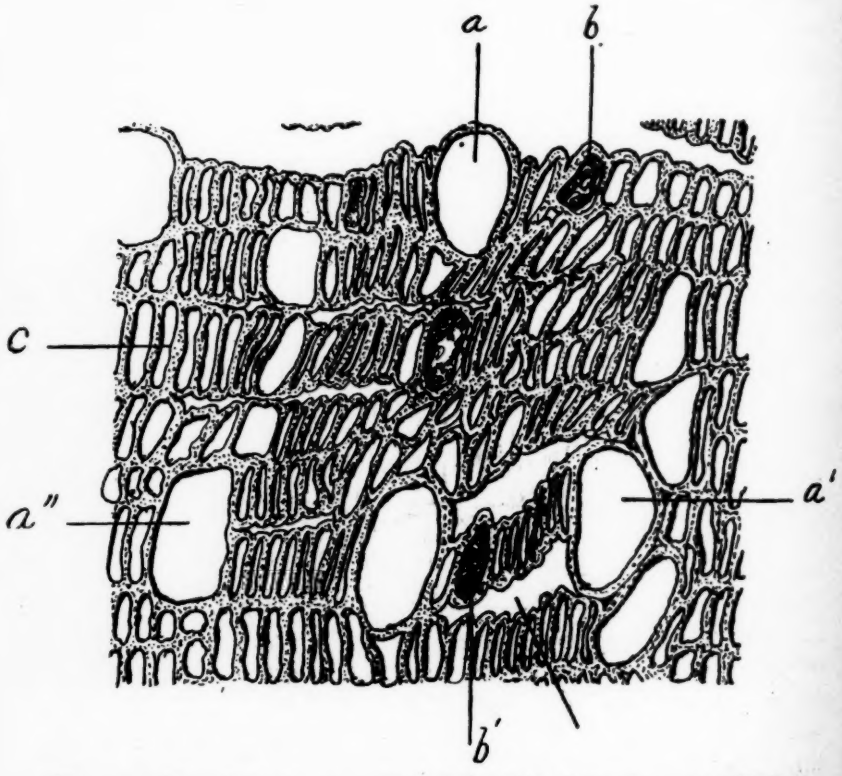

Fig. 7, small portion of cross-section of the bast of the stem, magnified 500 diameters. *a*, *a'*, *a''*, large mucilage cells (usually also containing tannin); *b*, *b'*, tannin cells; *c*, tangentially flattened sieve-tissues.

This species is destitute of bast fibres.

when rubbed with a glass rod. The petroleum ether dissolved the wax, some chlorophyll, and the fatty substances.

After the leaves had been completely exhausted with absolute alcohol, and as much as possible of this liquid drained off, the last

traces were removed with the aid of a water-bath, and the residue of the leaves was then treated with distilled water. This solvent extracted 5·56 per cent. of the leaves. Mucilage and glucose were present in this water extract.

Proximate Analysis of the Bark of the Stem.—This analysis was conducted as in the case of the leaves. Absolute alcohol removed all of the chlorophyll and other substances to the amount of 29·25 per cent. The alcoholic liquid was acid to litmus paper. From this alcoholic extract, water dissolved 8·65 per cent. of the bark, and afforded an acid solution which gave the following reactions:

Ferric chloride, dark green color and precipitate.
Bromine water, heavy yellow precipitate.
Calcium hydrate, little change, even on standing.

Petroleum ether, applied to the extract after the latter had been treated with water, dissolved most of the remaining coloring and waxy substances, but left undissolved a brown residue, consisting of resinous matter and the principle mentioned under the leaves as having a gritty character.

After extraction by absolute alcohol, the bark produced a thick, mucilaginous liquid with water. The liquid gave a precipitate when mixed with alcohol, and reduced Fehling's solution.

Estimation of Tannin in Leaves.—The hide powder method was employed in this and in all other estimations of tannin stated in this paper. There is reason to believe that the hide powder absorbs some of the acid principle as it does the tannin. The air-dry leaves showed 2·18 per cent. of tannin. They also contained 15·21 per cent. of moisture, which, if allowed for, will indicate 2·57 per cent. of tannin in leaves which are absolutely dry. The ash calculated for perfectly dry leaves was found to be 2·94 per cent. It consisted mainly of calcium phosphate with sulphate and carbonate, and a little silica.

Estimations of Tannin in the Barks of Stem and Root.—These were calculated as was done with the leaves, and the following chart is employed with the view of aiding comparison of the several parts of Pinus Strobus:

	Moisture.	Ash in Absolutely Dry.	Tannin in Moist Condition.	Tannin in Absolutely Dry.
Leaves	15·21	2·94	2·18	2·57
Stem bark	9·10	2·31	8·50	9·35
Root bark	11·16	4·67	5·76	6·48

The constituents of the ash of the bark appear to be identical with those of the leaves.

PINUS EXCELSA, WALL.

Proximate Analysis of the Leaves.—Absolute alcohol, applied as in the case of Pinus Strobus, removed 16·23 per cent. of the weight of the leaves. This extract contained almost all of the green coloring matter of the leaf, and showed a strongly acid reaction. When the extract was treated with water, an amount equal to 5·99 per cent. of the leaves was dissolved. This water solution had an acid reaction, and contained an iron-greening tannin. Much of the extract left undissolved by water was soluble in petroleum ether, to which it imparted a dark-green color. Some brown, resinous substance was undissolved by the petroleum ether. The principle exhibiting the gritty character, found at this stage in Pinus Strobus, was also found here.

Water applied to the leaves after their exhaustion with absolute alcohol dissolved 5·74 per cent. of their weight. The water solution contained mucilage in very small amount, but reacted decidedly with Fehling's solution for glucose.

Proximate Analysis of the Bark of the Stem.—This part yielded 25·06 per cent. of extract to absolute alcohol. The green color of the bark was entirely removed. The alcoholic liquid was acid in reaction. From this extract water dissolved 6·42 per cent. of the weight of the bark. The solution so obtained was acid in reaction, and behaved towards reagents in exactly the same way as did the corresponding extract in the analysis of Pinus Strobus.

Petroleum ether dissolved the chlorophyll and wax from the extract, but left considerable of a brown resinous substance, and the principle having the gritty character undissolved.

Water was next applied to the bark. It removed mucilage and glucose. Its solution was of a mucilaginous character, as was that of Pinus Strobus.

Estimations of Tannin in the Several Parts of Pinus excelsa.—These estimations were carried out as described under Pinus Strobus, and the results calculated in the same manner. The following table embodies the percentages:

	Moisture.	Ash in absolutely dry material.	Tannin in moist condition.	Tannin in absolutely dry condition.
Leaves	17·85	2·80	2·93	3·56
Stem bark	7·99	2·18	7·69	8·36
Root bark	8·99	3·03	6·08	6·68

The ashes of the several parts, upon qualitative analysis, showed the same composition as did the ashes of Pinus Strobus.

All the foregoing analyses of both species were made of young trees, growing in the vicinity of Philadelphia, and collected in the month of November. At some other seasons of the year the tannin would probably have been found in larger proportion in the stem bark.

(*To be continued.*)

ON THE CONSUMPTION OF ASPARAGINE IN THE NUTRITION OF PLANTS.[1]

By Y. Kinoshita, Nogakushi.

The fact that asparagine is formed whenever proteids undergo decomposition in plants has been repeatedly made the subject of close investigation by various authors, but much less attention has been hitherto paid to the reverse process—the regeneration of proteids from asparagine. C. O. Muller[2] has asserted that this regeneration can only take place during the process of assimilation in green leaves, and that the action of light and the *status nascens* of carbohydrates are essential. As this statement did not appear to me well founded, quantitative investigations being wanting, I undertook a series of experiments in order to see whether this process might not proceed in the dark.

If we look upon the growing root from the physiological point of view, we must hold it highly probable that the cells of the root, although always deprived of light, are capable of forming the proteids necessary for its growth and development from suitable sources, such as sugar, nitrates and sulphates, or sugar, asparagine and sulphates. It is a well-known fact that mould fungi can form their proteids in this way in complete darkness, and that certain fungi, especially bacteria, grow even much better in the dark than in daylight; it may, therefore, be surmised that the formation of proteids and protoplasm may also proceed better in darkness.

The *relative amount of glucose*, or other suitable material, seemed to me the most decisive factor in the transformation of asparagine into proteids. I therefore selected shoots of soya-beans, which are

[1] From Bulletin, Vol. II, No. 4, Imperial University, College of Agriculture, Tokio, Japan.

[2] Ein Beitrag zur Kenntniss d. Eiweissbildung in der Pflanze. Landw., Versuchst., Bd. 33, p. 11.

rich in asparagine, and tried to nourish them with organic materials, repeatedly making microscopical tests in the usual way with alcohol, as described by Borodin, Pfeffer and others, and finally determining the amount of asparagine still present by crystallization, according to E. Schulze's method.[1] Either methyl alcohol, glycerin or glucose was used as organic nutrient in solution along with calcium sulphate.[2] Every seventh or eighth day, this solution was replaced for a day by one containing 0·5 per mille each of the two potassium phosphates, and of hydrated magnesium sulphate, so as to furnish the necessary mineral matters. The cotyledons were cut off at the beginning of the experiment, in order to prevent further formation of asparagine by decomposition of the reserve proteids. A control experiment was made at the same time with soya shoots kept in water, in which an asparagine determination was made just before the other shoots were placed in their nutrient solutions, and again in others at the time when the shoots under investigation were analyzed.

The soya-beans were soaked in water on March 7th, sown on moist sawdust the next day and kept in the dark. In four days, at rather low temperatures, the seeds had germinated and the roots had reached the length of 2–3 cm. At this time I tested the tips of several roots microscopically for asparagine, and found only doubtful traces; but when the roots had become 6 cm. long, the presence of a moderate quantity was easily recognized. At this time the young plants were placed in water on a wire net.

After the length of the entire plants had reached 20–27 cm., and the stem and the root had been found to be rich in asparagine, by microscopical tests, a portion of the shoots was placed, on April 1st, (*a*) in a 1 per cent. solution of methyl alcohol mixed with one-tenth of its volume of saturated gypsum solution; (*b*) in glycerin[3] solution of 1 per cent. with gypsum, and (*c*) in glucose solution, the cotyledons of all the shoots having now been removed.

Whenever the solutions became turbid from bacterial growth, they

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[1] Landw., Jahrbuch, 1888, pp. 688 and 701; also 1880, p. 14.

[2] In some trials I made use of sodium acetate and tartrate, but not with satisfactory results, perhaps because the conditions were not favorable.

[3] Preliminary experiments had convinced me that a solution of 10 per cent. or even of 5 per cent. glycerin is not adapted for the further development of the plant. Indeed, in the 10 per cent. solution the shoots died after two days.

were renewed at once. When the hypocotylous part of the stem had reached about 30 cm. in length, growth seemed to stop in it, while the growth of the shoots above the cotyledons was now more marked than before. It may be mentioned that most of the leaves of the shoots cultivated in glycerin solution were somewhat larger than those grown in methyl alcohol. Microscopical examination exhibited now a very great difference between the amount of asparagine present in the control shoots, and that present in the other cases. Direct tests for the presence of dissolved reserve albumin, made upon an aqueous extract by addition to it of nitric acid, showed that there was none present in the shoots cultivated in sugar and glycerin. We see, therefore, that the decrease of asparagine is coincident with an increase of the dissolved proteids. Microscopical tests made it further highly probable that the amount of other amido-products was continuously decreasing, while tests for sugar with Fehling's solution revealed its presence in the shoots grown in glycerin, but neither in those grown in methyl alcohol nor in the control case.

Soon afterwards, on April 27th, a final measurement of dimensions and a quantitative determination of asparagine were made. The stem, without the hypocotylous part, had a length of 4–14 cm., in the control case No. 2; a length of 11–19 cm. in glycerin, and of 8–19 cm. in methyl alcohol.

The quantity of asparagine was as follows:

	Date of Determination.	Dry Matter in Grammes.	Asparagine in Grammes.	Asparagine Per Cent. in Dry Matter.
Control shoots, No. 1,	April 1st . . .	3·966	0·853	21·5
Control shoots, No. 2.	April 27th . . .	2·948	0·847	28·7
Control shoots, No. 3,	April 27th . . .	3·611	0·906	24·0
Shoots in methyl alcohol,	April 27th .	2·698	0·512	18·9
Shoots in glycerin,[1]	April 27th	4·590	0·629	13·7

[1] For determining the amount of asparagine in those shoots which had been kept in the dilute glucose solution, the material was not sufficient, but I microscopically examined the shoots for asparagine on May 8th (when some of the leaves showed brownish spots, indicating a gradual decay), and found a not inconsiderable amount of it still present. I do not doubt that if we could introduce more concentrated sugar solution into the cells of the shoots the shoots would continue to grow in the dark until all the asparagine had been transformed into proteids or protoplasm, provided the necessary mineral salts had been also introduced.

The determination of asparagine in the control shoot No. 1, was made after the removal of the cotyledons (April 1st), when the experiment proper commenced. If we compare this result with

that yielded by the control shoot No. 2, we find an increase of asparagine in percentage of dry matter, due probably to the gradual conversion of other amido-compounds into asparagine.[1] The fact that in the control case No. 3, where the cotyledons had not been removed, a smaller percentage of asparagine was found than in No. 2, may probably be due to the galactans and other carbohydrates gradually becoming soluble and getting consumed in support of respiration, thus protecting proteids as well as amido-compounds from further changes, and retarding the production of asparagine.

The principal conclusions which we can draw from the results obtained are:

(1) Glycerin and methyl alcohol, supplied by the roots, cannot only hinder the production of asparagine in the shoots, but are also capable of diminishing the amount already formed.

(2) Glycerin is much more effective than methyl alcohol. It also forms sugar in the cells.[2]

(3) Since shoots have been found to grow better in solutions of methyl alcohol and glycerin than in water, and also to show the presence of dissolved proteids by the nitric acid test, it is safe to assume an increasing protein production in the shoots thus nourished; in other words, methyl alcohol, as well as glycerin, can serve for the regeneration of proteids from asparagine, and as this process can go on in *perfect darkness*, light must be denied to have any *direct* action in supporting it.[3]

COTTON SEED OIL.

By Arthur R. Lewis, Ph.G.

[Abstract from Thesis.]

The first step in the process of manufacturing cotton seed oil consists in screening the seed to remove dirt and other foreign substances. The seed are then "relinted," as it is called, which implies the removal of any adhering cotton. This is accomplished by passing the seed through a machine in which small hooks and saws are

[1] Compare *O. Loew*, this Bulletin, Vol. II, No. 2.

[2] This formation of sugar is in accordance with the observations of Laurent, Ar. Meyer and Th. Bokorny. The latter author has also observed starch formation from methyl alcohol under the influence of daylight.

[3] It is however indirectly of great importance, because it yields the necessary carbohydrates; for, the more sugar there is present in a cell, the quicker will asparagine be transformed into proteids.

so arranged as to effect this purpose. The "relinting" done, the seed are hulled by means of buhr-stones set in such position that the hull, or testa, is cracked without crushing the seed to any considerable extent. The hulls are then separated by machinery from the internal portion of the seed, the endosperm, which is next passed between heavy chilled rollers. This treatment crushes the seed into a flat mass and thereby ruptures the oil cells. The crushed mass is put through heaters, in which it is cooked for fifteen or twenty minutes, and from which it is transferred to the cake-former. Here it is prepared for the press, and consists of a sticky mass. After the press boxes have been filled, hydraulic pressure is applied, usually from 3,000 to 4,000 pounds per square inch of cylinder ram. After the expression of the oil, the residue is known as press cake and cake meal.

The entire process, from the time the seed enter the screening "boll" until the oil is extracted and the cake removed from the press, occupies about thirty-five to forty minutes.

The yield of oil varies with the locality and richness of the soil, as well as with season and climatic changes. Moist soil affords the best yield. In some of the excessively dry summers of the Southwest the seed do not contain enough oil to pay for its extraction.

The average yield per ton of seed is from 36 to 40 gallons, or over 250 pounds, of oil. From 1 ton of seed about 30 pounds of lint, 900 pounds of hulls and 750 pounds of cake meal are also obtained. The remaining 70 pounds is made up of dirt and loss in working.

In Georgia and Mississippi and in some other sctions of the United States, the seed are sold by the bushel instead of the ton. It is estimated that a bushel of seed will yield from $1\frac{1}{2}$ to 2 gallons of oil, the amount depending upon the conditions under which the seed were grown.

In the crude state, the oil varies in color from a deep yellow to a ruby red, and sometimes to dark brown, or even black. The method of refining the oil consists in washing it with a solution of alkali. A solution of caustic soda, of about 12 to 15 per cent. strength, is usually employed. Of this, 1 pint is added to 10 pints of the oil. The mixture is thoroughly agitated for from thirty to fifty minutes. This treatment causes the precipitation of the coloring and albuminous matter; the precipitate is separated by

means of steam filters. The alkali remaining in the oil is neutralized by repeated washing with cold water, containing a small quantity of an acid. When the oil becomes neutral to litmus paper, it is run into large tanks. After standing in these for some length of time, the oil becomes of a bright lemon-yellow color, and is ready for commerce.

In some oil mills the treatment with alkali to remove color is not carried as far as is described above, but, to complete the refining, the oil is subsequently treated with bleaching powder and dilute sulphuric acid. This plan, however, is now rarely employed; for, since the oil has to some extent become an article of food, the unpleasant odor and taste imparted by the bleaching powder would condemn the brands purified by this means.

The loss in refining the oil is estimated to be from 5 to 8 per cent.

When the oil is subjected to cold and pressure the stearin separates, and much of that used in the manufacture of candles, etc., is now obtained in this way. Below 10° C. the oil solidifies. It has a specific gravity of ·920 to ·930 at 15° C.

A sample of cake meal was found by the author to contain 8·5 per cent. of ash. Nine per cent. of this ash was silica.

Two samples of cake meal from different companies were exhausted with petroleum ether, in order to ascertain the amount of oil contained. When the solvent was evaporated, 5·31 and 6·50 per cent. of oil were obtained. This points to the fact that a large part of the oil is not removed by the pressure applied.

Cotton seed meal contains about 9 per cent. of ammonia and 8 per cent. of other nitrogenous matter. The presence of the latter makes it a valuable food for cattle, the chief use to which it is put in the West; while for the same purpose large quantities of the meal are annually exported to Germany. It is further reported that some of the very poor people of that country make the meal into a bread which they say is palatable and wholesome.

The superiority of the cake meal over the entire crushed seed as a stock food lies in the fact that the greater part of the oil, which has a cathartic action, has been removed.

The hulls also are used as a stock food, but are much inferior to the meal.

On account of its nitrogenous constituents, and particularly the ammonia, the meal forms an excellent fertilizer.

The lint that is removed from the seed by the process of relinting is used for such purposes as padding clothing and cheap furniture.

The annual production of oil in 1888 was 500,000 barrels, while in 1893 it reached 940,000 barrels.

The uses of the oil in place of hog's lard for culinary purposes, as an adulterant of more expensive oils, as a constituent of oleomargarine, or butterine, and in the manufacture of high-class soaps, are all well known.

EDITORIAL.

No apology is offered for the dearth of editorial comments in this number, except the very obvious one that they are crowded out by original matter. Only one contribution has been copied from another publication, and that from a source inaccessible to most readers of this JOURNAL.

With such an array of the results of original research, we are led to believe that the scientific side of pharmacy is not falling into neglect. It is certain that there is as much necessity for research work as ever there was, especially in the line of establishing standards of strength and purity for medicinal preparations. If the energy wasted in writing long articles on "Pharmaceutical Education—Degrees and Requirements," and the "Past, Present and Future of Pharmacy," were turned into the proper channel, and the time lost by pharmaceutical bodies in listening to such "stuff" were otherwise occupied, the cause of pharmacy would be materially advanced. We admit that those relating to education are subjects for short papers and discussions, but only in the briefest manner. Of what use, however, is a long dissertation on the "Past, Present and Future of Pharmacy?" Yet we believe a paper with a title something like that was awarded some sort of a prize before a pharmaceutical body during the past summer. Of the past, it may be said, let it be past; of the present we know, and of the future we know nothing, and volumes of theory about improbable possibilities will not help us to know it any better. More laboratory facts and less writing-table theories are the crying necessities of the hour in pharmaceutical science.

At a recent examination of the *State Pharmacy Board*, held in Philadelphia, 85 applicants presented themselves for the certificate of qualified assistant, and 87 for that of registered pharmacist. Sixteen of the former and 11 of the latter succeeded in passing the examination, and were ordered to be registered.

At Pittsburg, 52 applicants presented themselves for the certificate of qualified assistant, and 56 for that of registered pharmacist. Eighteen of the former and 9 of the latter succeeded in passing a satisfactory examination, and were directed to be registered. At this rate the State will not be overrun with pharmacists very soon.

The next examination will be held in Philadelphia, on Saturday, January 18, 1896.

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

LES DROGUES SIMPLES D'ORIGINE VÉGÉTALES. Par MM. G. Planchon et E. Collin. Tome Deuxième. Paris: Octave Doin. 1896.

As promised one year ago, when the first volume appeared, this, the second volume, has been completed within the specified time. It is an octavo of 988 pages, and includes the index to the two volumes. The illustrations are numerous and of a high order of excellence, 753 of them being distributed through the text.

Volume I closed with the Campanulaceæ, and Volume II commences with the Compositæ, and terminates with the Ranunculaceæ. If one part of this second volume is more complete than another, it is that section devoted to the Cinchonas, in which a reasonable amount of space is devoted to those cultivated in India. Throughout the work, American drugs have received a full share of consideration, and the microscopic structure of many of them is illustrated.

An additional feature of the book is the illustration of the microscopic appearance of many drugs in powder form.

HANDBOOK OF PHARMACY, embracing the theory and practice of pharmacy, and the art of dispensing. By Virgil Coblentz, Ph.G., Ph.D., F.C.S. Second edition. Revised and enlarged, with 437 illustrations. Philadelphia: P. Blakiston, Son & Co. 1895. Pp. 572.

Just about a year ago, the first edition of Coblentz' Pharmacy was reviewed in this JOURNAL. The new edition has been enlarged and improved by the addition of a chapter on the "Analysis of Urine," and one on the "Applications of the Microscope in Pharmacy," both of which are attractively written, and increase the value of the book. This work has earned for itself a well-deserved reputation, and should be in the library of every pharmacist and pharmaceutical student in the country. Part III, on "The Art of Dispensing," is especially well written, and if more physicians would carefully study the whole work, and especially this part of it, there would, perhaps, be less mistakes for the pharmacist to detect, and fewer hair-breadth escapes for the patient.

THE ART OF COMPOUNDING, a text-book for students and a reference-book for pharmacists at the prescription counter. By Wilbur L. Scoville, Ph.G. Philadelphia: P. Blakiston, Son & Co. 1895. Pp. 264.

The author has experienced the need of an extended treatise on the prescription, and we can best convey an idea of the scope of the work by giving the titles of the chapters, as follows: Introductory; The Prescription; Nomenclature; Mixtures; Emulsions; Confections; Electuaries and Jellies; Pills; Lozenges, Troches, Bacills, Tablets, Pastilles and Lamels; Powders; Suppositories; Ointments, Cerates and Plasters; Poultices, Plasmas, Pencils and Medicated Dressings; Homœopathic Pharmacy; Incompatibility. The chapter on Homœopathic Pharmacy is a concise statement of that subject, and will be a novelty to most pharmaceutical readers.

The author has realized that dispensing pills is still an important part of the pharmacist's duty, and he has, therefore, devoted considerable space to the subject and done himself credit. The whole book is carefully written and will well repay thorough reading.

A PRACTICAL TREATISE ON MATERIA MEDICA AND THERAPEUTICS. By John V. Shoemaker, M.D., LL.D., Professor of Materia Medica, etc., in the Medico-Chirurgical College of Philadelphia. The F. A. Davis Company, Publishers, Philadelphia. Third edition. Revised.

This is a work of over eleven hundred pages, and as it treats of all of the official, and a large number of the unofficial drugs, both from the pharmacological and therapeutical standpoints, and of many of them in much detail, it constitutes one of our most comprehensive text-books on the subject.

This third edition has been extensively revised, and includes the description of many new drugs which have come into prominence since the last edition was issued. Also, as the author tells us, "The subject of treatment by means of animal extracts, secretions or juices, and immunized serum or antitoxins has been rewritten, and the endeavor has been made to give a fair presentation of the present state of knowledge concerning the value of these agencies in combating disease."

On the whole we have, in Dr. Shoemaker's work, a treatise intelligently conceived and executed, and one which embodies the results of the latest researches.

The volume consists of three parts. Part I is devoted to classification of the materia medica, the pharmacy of drugs, prescription writing, etc. Part II takes up the various drugs and treats of them in alphabetical order, giving (1) the botanical or chemical definition and physical characters of the remedy, with the strength and dosage of the various preparations; (2) its physiological actions, including toxicology and antidotes, with special effects, if any, upon individual organs and tissues; and (3) the therapeutical indications, with illustrative formulæ, suggestions, etc. Part III is devoted to non-pharmacal remedies, including electro-therapeutics, massage and rest-cure, pneumotherapy, hydrotherapy, climatotherapy, diet in disease, psycotherapy, etc.

It is scarcely possible that in a work of this character some shortcomings should not be observed. For example, on page 453, it is stated that the bark of the root of pomegranate is official, while that of the stem is not, whereas the U. S. P. of 1890 distinctly recognizes both. Also the author apparently uses *ine* and *in* indiscriminately as the terminal syllables of the names of active principles, a practice which must be confusing to the student, since by general consent, in this country at least, the names of alkaloids should terminate in *ine* while those of the non-alkaloids should terminate in *in*.

The author's classification of the drug-yielding plants, a classification essentially like that adopted by Brunton, is behind the times. Drs. Shoemaker and Brunton are by no means alone among writers on materia medica in ignoring the progress which botanical classification has made within recent years. It would be a refreshing sign and a decided novelty to meet with some work on the subject, whose botanical classification was really abreast of the times.

Another shortcoming we note is in the author's statement of the composition of the oil of wintergreen. He reiterates the statements of Cahours, made over a half century ago, that 90 per cent. of the oil consists of methyl-salicylate, and 10 per cent. of gaultherilene, while, as a matter of fact, it was demonstrated years ago, by Pettigrew and others, that the percentage of methylsalicylate is at least 99 per cent., and that 1 per cent. or less consists of a resin solid mixture, whose composition has not been completely ascertained.

But the above are minor defects, which do not seriously mar a valuable work.

The publishers are to be congratulated on the good appearance of the book.

E. S. BASTIN.

OUTLINES OF MATERIA MEDICA AND PHARMACOLOGY. By H. M. Bracken, M.D., Professor of Materia Medica, Therapeutics and Clinical Medicine, University of Minnesota. Philadelphia: P. Blakiston, Son & Co. 1895.

There is doubtless a growing demand in our medical schools for more compact text-books. Many of the older ones and some of the new are not only expensive, but they are too long-drawn-out to permit of the student's reading them thoroughly, do equal justice to a dozen or more other text-books of similar length on other branches of medicine, and at the same time accomplish the large amount of laboratory work required in a modern medical course, all in the limited period of three or four terms. Hence the diminished sale of such comprehensive works, and the increasing popularity of quiz-compends. The majority of the latter, however, err in going to the opposite extreme. They are often too skeletal and juiceless, deal too exclusively with the baldest facts, and too little with reasons, to satisfy the student who has a care to know his profession, and not merely to pass his examinations.

The writer of this work seems to have appreciated the situation and to have avoided both extremes. He has given the essentials of a vast subject within the limits of less than four hundred pages, and has done it in a way that is far from dry and uninteresting. Excellent judgment has been exercised in the selection of the facts to be presented and those to be excluded, so that the book contains little that is not of direct value to the practitioner. What the author says about the action and uses of drugs, while, of course, condensed and pithy, is singularly lucid and full of helpful suggestion to the thoughtful student.

The plan of the book is simple. After the introduction, which deals with such topics as Official Preparations, Administration of Drugs, Dosage, Prescription Writing, Physiological Action of Drugs, etc., the different *materia medica* are treated of in the following order: (1) The Acids; (2) The Metals; (3) The Non-Metallic Elements; (4) The Carbon Compounds; (5) The Animal Kingdom; (6) The Vegetable Kingdom.

E. S. BASTIN.

YEAR-BOOK OF PHARMACY. London: J. & A. Churchill. 1895. Pp. 455.

The present volume of this valuable annual is fully up to the standard of its predecessors. The excellent character of the papers read at the Bournemouth meeting we have commented on before, and most of them were published in abstract in the September number of this JOURNAL.

CONTRIBUTION TO THE FLORA OF YUCATAN. By Charles Frederick Millspaugh. Field Columbian Museum: Publication 4. Botanical series, Vol. I, No. 1. Chicago, 1895.

We learn from the introduction "that little is known of the details of the botany of Yucatan, except that it is very poor and scanty, and largely composed of plants that still bear long droughts without injury. The poverty of the flora is ascribed to the fact that the copious rains rapidly filter away through the porous limestone substratum.

"In 1835 Jean Jules Linden, a Belgian horticulturist, gathered about twenty-five species of plants in Yucatan, while on his way to Vera Cruz." Further collections were made in 1848, by Hon. E. P. Johnson, of seventy five species; and in 1885 and 1886, by Dr. George F. Gaumer, of 224 species.

The latest expedition was made in January, 1895, by Allison V. Armour, and the result has been a very material addition to the knowledge of the flora of Yucatan.

NOTES ON THE COMMERCIAL TIMBERS OF NEW SOUTH WALES. By J. H. Maiden. Sydney, 1895. Pp. 32

The author prefaces the enumeration and description of the various native woods by brief information on the forest wealth of the colony, timbers for export, seasoning processes, the proper time to fell timber, etc.

The various commercial timbers are then classified, and each is briefly described. The contribution is of value to the inhabitants of New South Wales and of interest to the foreign reader. It is issued under the authority of the Minister for Mines and Agriculture.

MINNESOTA BOTANICAL STUDIES.—Geological and Natural History Survey of Minnesota. Conway MacMillan, State Botanist. Bulletin No. 9, Part VII. With seven plates.

The following contributions make up this number: "On the Genus Cypripedium, L., with Reference to Minnesota Species." By Henrietta G. Fox. "Poisonous Influence of Various Species of Cypripedium." By D. T. MacDougal. "Tree Temperatures," recorded by Roy W. Squires. "Some Hepaticæ of Minnesota." By John W. Holzinger. "A Study of Some Minnesota Mycetozoa." By E. P. Sheldon. One of the plates shows, by map, the distribution of the genus Cypripedium in North America.

KENTUCKY PHARMACEUTICAL ASSOCIATION PROCEEDINGS. 1895.

The Proceedings of this Association show that the members are endeavoring to replace all ready-made preparations—secret, non-secret and proprietary—by honest, National Formulary products, and, in that undertaking, we wish them success.

VIRGINIA PHARMACEUTICAL ASSOCIATION PROCEEDINGS. 1895

Several meritorious papers appear in the Proceedings of this Association, and the only criticism to be made is that these original papers are given an inconspicuous place in the appendix.

SEMI-ANNUAL REPORT OF SCHIMMEL & Co., Leipzig and New York. October, 1895.

NOTES ON LOCAL ANÆSTHESIA BY INFILTRATION, as suggested by Dr. C. L. Schleich. Philadelphia: John Wyeth & Brother. This contains the formulas of a number of tablets recommended for local anæsthesia, by Dr. Schleich, of Berlin, and by Dr. Van Hook, of Chicago.

A COMPEND OF PHARMACY. By F. E. Stewart, M.D., Ph.G. Philadelphia: P. Blakiston, Son & Co., 1895. Pp. 187. Fifth edition.

We cannot say much for a "quiz compend," "aid," or anything else that is intended to assist the student to "cram" for examination, no matter how

creditably written. It is not this work in particular that we single out for disapproval; it is the whole class.

THE PHYSICIANS' VISITING LIST for 1896. P. Blakiston, Son & Co. This well-known list has reached its forty-fifth year of publication, and comes with several new features that make it better than ever.

MINUTES OF THE PHARMACEUTICAL MEETING.

PHILADELPHIA, December 17, 1895.

On motion of Mr. Wiegand, Mr. George M. Beringer was chosen chairman. On motion of Prof. Trimble, the reading of the minutes of the previous meeting was omitted, and they were ordered to stand as published.

The next in order of business were presentations to the Library and Museum. The following is a list of the books presented; sixteen volumes of the Labor Commissioner's Reports; British Year-Book of Pharmacy, 1895; No. 4 of Vol. III, Department of Agriculture; United States National Herbarium; Reprint of Collection of Plants from Northern Idaho; Materia Medica and Therapeutics, third edition, by J. V. Shoemaker, M.D. Through the American Journal of Pharmacy: Stewart's Compend of Pharmacy; Scoville's Art of Compounding; Proceedings of the American Academy of Arts and Sciences, Boston, 1895; Special Consular Reports—Highways of Commerce, 1895; Contributions from the Herbarium of Franklin and Marshall College, 1895; and, through the instrumentality of Mr. Howard B. French, eighty-five volumes of Reports of the Interior Department were presented by General H. H. Bingham.

Attention was called to a set of hydrometers, presented by Mr. Charles Bullock, on behalf of Mr. L. C. Francis, one of the oldest and most reliable makers of physical and scientific apparatus in this country.

Two samples of carborundum, from the Niagara Electric Works, presented by Charles Bullock and C. A. Seither, Ph.G., were shown.

A sample of dry Anti-Diphtheritic Serum, manufactured by Messrs. Burroughs, Wellcome & Co., of London, and sent by Messrs. Fairchild Bros. & Foster, was exhibited. The serum, in the form of golden scales, is put up in tubes containing one gramme, which is said to represent ten cubic centimetres of normal liquid Anti-Diphtheritic Serum. Professor Trimble was of the opinion that, if it retained its potency, this would probably become the leading form.

The first paper, on "Distilled Water," by Prof. J. U. Lloyd, of Cincinnati, was read by Professor Trimble, who remarked that this paper was of particular interest on account of the action taken during the past year to enforce the Pure Food Law in Ohio. Two samples of distilled water, prepared and tested as described in the paper, were shown. One of these contained a flaky sediment, and the residue obtained upon evaporation of 1,000 c.c. of a similar sample was also shown. Considerable discussion arose in reference to the composition of this sediment, Professor Trimble believing it to be due to the solvent action of the water on the glass. Mr. Kebler held a different opinion, and stated that it was calcium sulphate from the still. Mr. F. W. Haussmann raised the question as to its bacteriological character, but the fact of the water containing this sedi-

ment standing the permanganate test, seemed to give a negative answer to this question.

The second paper, entitled "Some Observations on Kola," by Messrs. A. R. L. Dohme and Hermann Engelhardt, of Baltimore, was also read by Professor Trimble. The main object of these investigators was to establish the relative alkaloidal value of the African and Jamaica nuts, the latter costing about one-third more than the former. An album containing illustrations relative to the cultivation of the kola plants in Jamaica, and belonging to Mr. A. F. Kilmer, of the firm of Johnson & Johnson, was shown, and, in compliance with a request from Professor Trimble, Mr. Kilmer made some remarks on this subject. He said he was surprised that the authors made no reference to kolanin, which is found in the green nuts. This drug has been found to have marked value in sustaining athletes during excessive bodily exercise, and its value as a heart stimulant is augmented by the fact that no reaction seems to follow its use.

Mr. Beringer stated that he had used benzol in some experiments on guarana, and its possible utility in extracting the similar alkaloids of kola was suggested thereby.

Mr. Lyman F. Kebler read a paper on "Spermaceti," and showed samples of that substance. Mr. Kebler regards the ether number, the acid number and the saponification equivalent as important means of establishing the identity and purity of this commodity, and in comparing the results obtained in his work on various samples, he was led to the conclusion that the tests of the U. S. Pharmacopœia for this substance answer more nearly for those of cetin. His method of obtaining the specific gravity of spermaceti and similar substances is of interest. The substance is melted and allowed to drop on a surface of glass, and the little plates so obtained allowed to float in a mixture of alcohol and water, the specific gravity being determined from the specific gravity of the liquid.

Professor Remington stated that the crystalline character of spermaceti is modified by the amount of pressure used in its manufacture, and that a finer product is obtained in cold weather. He furthermore stated that, in order to determine the value of the pharmacopœial tests, absolutely pure spermaceti should be used in making observations.

Mr. Chas. H. LaWall then read a paper entitled "Beechnut Oil," and exhibited some beechnuts collected in Sullivan County, this State, and also a sample of oil which he had expressed from nuts obtained in the same locality. Mr. LaWall, in replying to a query from Professor Remington, said that beechnut oil is not an article of commerce in this country, as he had made several attempts to purchase it, but did not succeed.

The Chairman called attention to specimens of elder roots sent by Mr. Howard B. French, which had grown in a drain. The numerous rootlets so produced were so fine and interlaced as to form a spongy mass corresponding in shape to that of the drain.

Mr. Wm. B. Thompson presented specimens of native borax and calcium borate which had been obtained from the borax region in California and Nevada.

Mr. Beringer read a paper on "Rhus Poisoning." Several efficient remedies for this trouble were suggested in his paper, and also by others present. Mr. Beringer stated that the volatile acid is the toxic principle, and that the dried

leaves are not poisonous—this fact suggesting the advisability of their adoption in the U. S. Pharmacopœia.

A new form of suspension balance was exhibited and described by Dr. J. R. Witzel. The beam is suspended by two wires of German silver, or copper, so that knife edges are avoided. The smaller balances are sensitive to ·02 grain.

Mr. Wm. R. Warner sent a programme of the graduating class of 1856, accompanied by his matriculation ticket. The subjects of the theses indicated the high character of the work done by the students of those days.

Professor Remington desired to personally thank the authors of the papers for their contributions, and said that we had cause for hoping that the high standing of the College would be maintained, when six original papers were on the programme of one meeting.

The papers were referred to the Publication Committee, and, on motion of Professor Trimble, the meeting adjourned.

T. S. WIEGAND,
Registrar.

NOTES AND NEWS.

A borax-carmine staining fluid is prepared by P. W. Squire (*Phar. Journal*, December 7, 1895), as follows:

Carmine	3 grammes.
Borax	4 "
Distilled water	85 cubic centimetres.
Alcohol	115 " "

Dissolve the borax in the water, add the carmine and heat in a flask until the mixture just boils. Cool the solution and add gradually to the alcohol; after twenty-four hours, filter. At first sight the borax would appear to be in excess, but the proportion given is necessary to dissolve the carmine. The solution stains well and is more alcoholic than that known as Grenacher's. There are many far better nuclear stains, notably hæmatoxylin and some aniline dyes, but there is none as good as borax-carmine for staining cellulose.

The metal glucinum, it is stated, is emerging from its position as a chemical rarity, and is coming to the front, much as aluminum did a few years ago. It is even lighter than aluminum, but its chief value consists in the fact that its electrical conductivity is as high as that of silver, and, consequently, higher than that of copper. It is less extensible than iron, and more durable. At present, its value is 7ɪs. 4d. per pound, which is prohibitive for large quantities, but this is only one-tenth the price of platinum, weight for weight, and one-one-hundred-and-sixtieth the price of platinum, volume for volume.—*Ironmonger*, November 16, 1895.

Improvements in the *manufacture of acetone and in the apparatus therefor*, is the subject of a patent by R. Jürgensen, Prague, and A. Bauschlicher (English Patent No. 23,438, December 3, 1894). The claim is for an improved process for the manufacture of acetone, by distilling in a retort jacketed with molten lead, a basic calcium acetate, which is made by adding 5 per cent. of lime to a very concentrated solution of calcium acetate, and evaporating to dryness. The jacket of molten lead is used in order to avoid overheating the contents of the retort and consequent formation of by-products. The contents of the retort are

stirred during the distillation, and the acetone formed is carried off by a current of indifferent gas (such as generator gas, water gas or superheated steam). The mixture of gas and vapor passes through a box where dust is deposited, after which the acetone is condensed. The crude product is purified by mixing it with water, which dissolves the acetone and leaves the tarry impurities undissolved. After these have been removed, the clear, aqueous solution is submitted to fractional distillation. From 100 parts of acetate of lime, 25 to 26 parts of pure (99·5 per cent.) acetone are obtained.—*Jour. Soc. Chem. Industry*, November 30, 1895.

The following note on *camphor* from the *Kew Bulletin*, of November, 1895, will throw some light on the price of this commodity:

"The increased demand for this substance, which is obtained by distillation from the wood of Cinnamomum Camphora, a tree of Japan and China, has led to inquiries being addressed to Kew, as to its extended cultivation in the Colonies. It grows freely in Southern Europe and is suitable for planting in any warm temperate climate.

"The following note is extracted from the *British North Borneo Herald*, for September 16, 1895:

"'Nearly twenty years ago Formosa camphor was quoted at $20 per picul; but from various causes, chiefly owing to the invention of smokeless gunpowder, in the manufacture of which it is largely used, the price has now risen to $79 per picul. In this connection it is a curious fact to note that camphor, which discharged a large volume of carbon during combustion, should produce a smokeless compound.'

"The cause assigned for the rise of price proves to be erroneous, as will be seen from the following note, for which Kew is indebted to Sir Frederick Abel:

"'Camphor *was* used in the earliest days of the manufacture of a successful smokeless powder for artillery and small arms; but its employment was soon demonstrated to be attended with serious practical disadvantages, and its application for this purpose can, therefore, not be said to have been other than experimental, and of no great importance even at that time, as affecting the market value of camphor.'

"'This substance has, however, been used extensively for many years past, and no doubt in continually increasing quantities, for the conversion of collodion cotton into the material known as celluloid, which is applied to the manufacture of imitation ivory, tortoise-shell, horn, and a great variety of purposes.'"

According to a patent of F. Bayer & Co. (English patent No. 22,617, November 22, 1894), the patentees had formerly found that acetylamido-phenyl salicylate does not possess the toxic properties of salol, and can be substituted for it with advantage. They now find that the lactylamidosalol is superior to the acetyl compound, owing to its greater solubility in water. They claim the lactylamidophenyl salts, salts of salicylic acid, and of ortho-, meta- and para-cresolcarboxylic acids. These are made by acting on amidosalol or the corresponding compounds of the cresolcarboxylic acids, with lactic acid, lactic anhydride, lactide, or an ethereal salt of lactic acid. They may also be obtained from lactamide and a salt of amidosalol.—*Jour. Soc. Chem. Industry*, November 30, 1895.

CLASSES

—OF THE—

PHILADELPHIA COLLEGE OF PHARMACY,

SEVENTY-FIFTH ANNUAL SESSION, 1895-1896.

FIRST YEAR CLASS.

Name.	*Place.*	*State.*	*Preceptor.*
A'Becket, Thos. Hopkinson,	Philadelphia,	Pa.	J. J. Moore.
Abrams, Fred. Arthur,	Philadelphia,	Pa.	John Wyeth & Bro.
Albert, Harry Clay,	Maysville,	Ky.	
Albright, Chas. Henry,	Philadelphia,	Pa.	John P. Frey.
Althouse, Harry B.,	Harrisburg,	Pa.	F. J. Althouse.
Anderson, Geo. Chas.,	Meadville,	Pa.	A. L. Ballenger.
Anderson, Ralph,	Latrobe,	Pa.	Jesse W. Pechin.
Baer, Lemuel Miles,	Lancaster,	Pa.	A. A. LeFevre.
Ballamy, John Francis,	Tavistock,	Eng.	H. T. Gregory.
Barr, David Ford,	Elkton,	Md.	B. J. Stathem.
Barth, Chas.,	Philadelphia,	Pa.	W. G. Nebig.
Bartholomew, Arthur,	Golden Gate,	Cal.	J. M. Higgins.
Bates, John Phillips,	Mansfield,	Pa.	J. M. Smith.
Batsford, Ernest James,	Waterloo,	N. Y.	Batsford & Bisdee.
Beane, Geo. Ridenour,	Bainbridge,	Pa.	H. C. Blair.
Beardsley, Carrie Frances,	Chicago,	Ill.	
Beauchamp, Roscoe Frank,	Baltimore,	Md.	Chris. Petzelt.
Beavans, Wm. Eugene,	Enfield,	N. C.	P. Fitch, M.D.
Beh, Ed.,	Philadelphia,	Pa.	Geo. W. Goldsmith.
Berberich, Herman,	Baden,	Germany,	Eberly Bros.
Berg, Harry Chas.,	Philadelphia,	Pa.	Special Chemistry,
Berry, Robert Taylor,	Charlestown,	W. Va.	P. H. Franklin.
Beyerle, Chas. Wellington,	Bernville,	Pa.	Edwin M. Boring.
Bicking, Edgar Clifton,	Chester Co.,	Pa.	John L. Woodruff, M.D.
Bingman, Harry Clayton,	Jersey Shore,	Pa.	J. F. Gray.
Bishop, David Kirlin,	Patterson,	Pa.	M. P. Crawford.
Black, Robert Morris,	Philadelphia,	Pa.	P. M. Kelly, M.D.
Bloor, Alfred Wainwright,	Manor,	Tex.	
Booth, Harry Emanuel,	Camden,	N. J.	J. V. Antill, M.D.
Booth, John Franklin,	Roanoke,	Va.	C. C. Hudson.
Booth, Thos.,	Philadelphia,	Pa.	Alex. Wilson.
Brach, Cornelius,	Kercenkien,	Germany,	W. E. Miller.
Bradford, Edward Burton,	Newport,	N. J.	A. La Dow.
Bready, Wm. Ramsey,	Philadelphia,	Pa.	A. J. Frankeburg.
Brennan, Thos. Francis,	New London,	Conn.	W. B. Moon.
Brewton, Swain Hoffman,	Cape May City,	N. J.	Wm. Porter.
Brown, Hampton Housman,	Pleasant Grove,	Pa.	B. L. Brown, M.D.
Brown, James Lawrence,	Philadelphia,	Pa.	McClure, Heritage & Co.
Brueckmann, Walter,	Philadelphia,	Pa.	Emil Jungmann.
Buckingham, Harry Sheldon,	Clayton,	N. J.	H. G. Shinn.
Calloway, Henry Willis,	Baltimore,	Md.	
Calvert, James Howard,	Perryville,	Md.	N. C. Cameron.
Cassel, Oscar Heebner,	Norristown,	Pa.	Wm. Stahler.

Name.	*Place.*	*State.*	*Preceptor.*
Chadwick, Samuel Hilton,	Wilmington,	Del.	Z. James Belt.
Clark, John Edward,	Lock Haven,	Pa.	W. K. Saxton.
Clark, Robert Hall,	Union City,	Ind.	J. P. Frey.
Cliffe, Joshua,	Norristown,	Pa.	W. L. Cliffe.
Cohen, John Thos.,	Upland,	Pa.	R. H. Henderson.
Coleman, John Edward,	Carbondale,	Pa.	B. A. Kelly.
Cooper, Walter Greenlee,	Savannah,	Mo.	J. P. Cooper.
Cowen, John James,	New York,	N. Y.	R. R. May.
Cox, Linwood,	Norristown,	Pa.	Atwood Yeakle.
Crawford, Victor Horace,	S. Bethlehem,	Pa.	Geo. W. Roland.
Creighton, Wm. Stewart,	Barnesville,	O.	I. J. White.
Cunningham, Orrick Sim,	Clear Spring,	Md.	Geo. W. Hurd.
Dale, David,	Philadelphia,	Pa.	John Wyeth & Bro.
Davis, Geo. Eckley,	Eckley,	Pa.	C. J. Schneider.
Davis, Jacob Bumgardner,	York,	Pa.	J. R. Smyser.
Davis, James Joseph,	Scranton,	Pa.	C. Lorenz.
DeBeust, Wm. Harry,	Philadelphia,	Pa.	R. H. DeBeust, M.D.
Decker, Wm. Robert,	York,	Pa.	R. Wm. Ziegler.
DeHaven, Ida Valeria,	Bayonne,	N. J.	J. E. Salter, M.D.
Dirmitt, Chas. Walter,	Philadelphia,	Pa.	Chas. H. Dirmitt, M.D.
Dorwart, Wm. Elmer,	Lancaster,	Pa.	A. G Hosteller.
Donahue, John Linton,	Bloomsburg,	Pa.	Moyer Bros.
Doudna, Joel S.,	Belmont Co.,	O.	J. T. Ely Co.
Downing, Wm. Henry,	Wilmington,	Del.	N. B. Danforth.
Dreher, John Howard,	Ashland,	Pa.	R. J. Williams.
Dubell, Alex.,	Mt. Holly,	N. J.	R. C. Barrington, M D.
Eason, David Clark,	Brookville,	Pa.	Shinn & Baer.
Eckels, Frank Huston,	Mechanicsburg,	Pa.	C. A. Eckels.
Entwistle, Albert Henry,	Philadelphia,	Pa.	Chas. H. Roberts.
Estlack, Walter Forrest,	Philadelphia,	Pa.	H. W. Estlack.
Evans, Abner Thos.,	Greensburg,	Pa.	S. P. Brown.
Evans, Samuel, Jr.,	Circleville,	O.	Evans & Kimmel.
Farrow, Fred. Reeves,	Leipsic,	Del.	Eberly Bros.
Faulhaber, Gustave Adolph,	Loudonville,	O.	S. H. Shull.
Felty, Harvey Long,	Palmyra,	Pa.	A. C. Hersh.
Fenner, Harvey Albert,	S. Bethlehem,	Pa.	Campbell & Bro.
Fisher, Samuel Keim,	Lititz,	Pa.	James C. Brobst.
Fleming, John Halbert,	Collamer,	Pa.	A. W. Smedley, dec'd.
Fletcher, Wm, Ridings,	Philakelphia,	Pa.	R. Powers Wilkinson.
Foltz, Edgar Sam'l Grant,	Bethlehem,	Pa.	N. B. Danforth.
Ford, Edward Frank,	Chester,	Pa.	F. E. E. Hudson.
Fortson, Sam'l Anthony,	Washington,	Ga.	J. G. Wright.
Foster, Wm. Newell,	Philadelphia,	Pa.	Wm. H. Saurer.
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Friebely, Harry Eugene,	S. Bethlehem,	Pa.	H. A. Burkhart, M.D.
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Funk, Clifford Altamont,	Lancaster,	Pa.	J. A. Miller.
Funk, Robert Rowland,	Hagerstown,	Md.	Blew & Lucas.
Gage, Porcius Silkman,	Vineland,	N. J.	
Garrison, Joseph Miller, Jr.,	Elmer,	N. J.	Theodore Campbell.
Geiger, Edward Geo.,	Peoria,	Ill.	F. H. Vonachen.
Gerhardt, Carl,	Altoona,	Pa.	Jos. A. McKee.
Gibb, Andrew,	Lock Haven,	Pa.	W. C. Franciscus.
Gladhill, James White,	Jersey Shore,	Pa.	G. M. Beringer.
Godshall, Samuel R.,	Soudertown,	Pa.	Smith, Kline & French Co.
Grakelow, Ralph,	Tower City,	Pa.	I. P. Amick.
Grausam, Nicholas Jacob,	Wilkes-Barre,	Pa.	Wenner & Co.
Greenamyer, Byron Leroy,	East Palestine,	O.	E. Greenamyer, M.D.

Name.	*Place.*	*State.*	*Preceptor.*
Greenamyer, Chas. Harry,	Alliance,	O.	Cassaday Drug & Chem.
Griffith, Oliver Brownback,	Uwchland,	Pa	Chas. A. Smith.
Groff, Harry Musselman,	Lancaster,	Pa.	Warrington & Pennypacker.
Groff, Wm.,	Quarryville,	Pa.	T. M. Rohrer, M.D.
Grunden, Percival Edward,	Steelton,	Pa.	G. A. Gorgas.
Guth, Herbert Wallace,	Allentown,	Pa.	Peters & Smith.
Haines, Samuel Wolston,	Camden,	N. J.	F. S. Macpherson.
Handel, John Conrad,	Philadelphia,	Pa.	D. J. Weidner.
Hassenplug, Albert Winthrop,	Mifflinburg,	Pa.	J. C. Hayes.
Haus, Ralph Leonard,	Mifflinburg,	Pa.	W. H. F. Vandegrift.
Hebden, Wm.,	Philadelphia,	Pa.	C. Scattergood.
Heckeroth, Wm. Conard,	Philadelphia,	Pa.	Special Chemistry.
Heintzelman, August,	Philadelphia,	Pa.	J. A. Heintzelman.
Helmbold, Anna Palmer,	Philadelphia,	Pa.	F. W. E. Stedem.
Herbuveaux, Jules,	Utica,	N. Y.	J. H. Sheehan & Co.
Heverly, Fred. Chase,	Wilkes-Barre,	Pa.	R. D. Williams.
Hixson, Jesse Lee,	Crystal Spring,	Pa.	R. H. Lackey.
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Huber, Wm.,	Atlantic City,	N. J.	Nelson Ingram, M.D.
Hudson, Harry, Jr.,	Philadelphia,	Pa.	
Huntington, Joseph,	Philadelphia,	Pa.	J. C. Perry.
Ingling, Howard Edgar,	Riverton,	N. J.	J. M. Cowperthwaite.
Jacobs, John Taylor,	Wilmington,	Del.	J. P. Williams.
Jaeger, Chas. Fred.,	North Adams,	Mass.	E. E. Bortick.
Jefferis, David Strode,	Philadelphia,	Pa.	Funk & Groff.
Jenkins, Frank Hieston,	Hanover,	Pa.	J. L. Emlet
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Keen, Geo. Samuel Jacob,	Wiconisco,	Pa.	C. D. Christman, M.D.
Keenan, John Joseph,	Philadelphia,	Pa.	J. J. Burke, M.D.
Keim, Joseph Paxson,	Bristol,	Pa.	Emlin Martin.
Kepner, Weldon Stover,	Shippensburg,	Pa.	J. C. Attick & Co.
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King, James David,	Easton,	Pa.	Rowland Willard.
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Kohl, Geo. Michener, Jr.,	Jenkintown,	Pa.	T. C. Cottman.
Krewson, Chas. Merrill,	Philadelphia,	Pa.	Geo. S. R. Wright.
Krewson, Wm. Egbert, Jr.,	Philadelphia,	Pa.	Wm. E. Krewson.
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Latchford, Orwan Luther,	Markelsville,	Pa.	D. H. Ross.
Lee, Walter Evan,	Vineland,	N. J.	Bidwell & Co.
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Lightcap, Wm. Edward,	Smyrna,	Del.	G. M. Beringer.
Lindig, Chas. Warren,	Lewisburg,	Tenn.	H. N. Hoffman.
Lippincott, David Alfred, Jr.,	Burlington,	N. J.	H. B. Weaver.
Longshaw, Thos. Elmer,	Philadelphia,	Pa.	J. B. Moore.
Luebert, August Gustav,	Philadelphia,	Pa.	David A. Over.
MacBride, Wm. Vaughan,	Philadelphia,	Pa.	W. F. Seiler.

Name.	*Place.*	*State.*	*Preceptor.*
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McCurdy, Edgar,	Philadelphia,	Pa.	Healy & Frey.
McDonnell, Joseph Francis,	Centralia,	Pa.	C. F. Chandler, M.D.
McGarrah, Wm. Henry, Jr.,	Scranton,	Pa.	F. W. E. Stedem.
McIntyre, Andrew James,	Catasauqua,	Pa.	E. L. Klopp & Co.
McKeown, Geo. Washington,	Philadelphia,	Pa.	Wm. Mann.
MacNair, Hugh,	Jarratt,	Va.	Lawson C. Funk.
Mahoney, James Norris,	Bridgeport,	Pa.	F. E. Himmelwright, M.D.
Malin, George Lawrence,	Atlantic City,	N. J.	Willard Wright, dec'd.
Markley, Harry Genet,	Camden,	N. J.	Harry Guest.
Mathers, Grace,	Philadelphia,	Pa.	Susan Hayhurst, M.D.
Metzler, Walter Scott,	Baltic,	O.	A. S. Metzler.
Middleton, Claud Ruoff,	Philadelphia,	Pa.	Shinn & Baer.
Miller, George Washington,	Lancaster,	Pa.	George W. Hull.
Miller, Wm. Fred.,	Erie,	Pa.	Wm. Fischer.
Mills, Leopold John,	Cardington,	O.	H. S. Mooney.
Moeckel, Raymond Light,	Lebanon,	Pa.	V. H. Allwein, M.D.
Monaghan, Thos. Francis,	Philadelphia,	Pa.	H. D. Stickter, M.D.
Monroe, William Robeson,	Fresno,	Cal.	George H. Monroe.
Moore, Fred. Smith,	Wilmington,	Del.	Beacon Dispensary.
Morell, Charles Joseph,	Philadelphia,	Pa.	Charles M. Morell.
Morgan, Francis Wm.,	Pass Christian,	Miss.	Wm. Greve.
Morse, Thomas,	Montgomery,	Ala.	H. G. Eakin.
Ney, Howard Jacob,	Hamburg,	Pa.	C. F. Kramer.
Nixon, Robert Brighton, Jr.,	Mifflintown,	Pa.	M. P. Crawford.
Obear, Josiah Julian,	Winsboro,	S. C.	O. Y. Owings.
Otto, Glenn Frazier,	LaCrosse,	Wis.	Oscar Houck
Parry, Edward,	N. Cramer Hill,	N. J.	W. H. Hensinger, M.D.
Parry, Wm. Hough,	Newtown,	Pa.	J. S. Brown.
Parse, Andrew Connet,	Flemington,	N. J.	J. Sherman Coley.
Parvin, John Pearson,	Reading,	Pa.	W. F. Potteiger.
Pasold, Julius Martin,	Joliet,	Ill.	H. F. Voshage.
Pearce, Samuel Robert,	Manasquan,	N. J.	Andrew Blair.
Pechin, Edward Charles,	Philadelphia,	Pa.	G. J. Pechin.
Peck, Wm.,	Nottingham,	England,	A. R. Hesske.
Perse, James Woodlock,	Plymouth,	Pa.	James V. Perse.
Pettebone, Thomas J.,	Dorranceton,	Pa.	C. W. Spayd, M.D.
Phillips, John Henry,	Redfield,	N. Y.	Wm. H. Phillips.
Pierce, John Jeremiah,	Sanford,	Pa.	F. E. Geuther.
Pipes, William Henry,	Millington,	Md.	
Prosser, David Davis, Jr.,	Hellertown,	Pa.	J. Howard Evans, M.D.
Putt, Milton Thos.,	Lebanon,	Pa.	W. B. Means, M.D.
Raker, John Wilson,	Pillow,	Pa.	Chas. H. Tatem.
Randolph, Edward Fitts,	Plainfield,	N. J.	L. W. Randolph.
Rankin, James Lockhart,	Jacksonville,	Fla.	W. K. Lits.
Remmel, Geo. Swartz,	Port Royal,	Pa.	F. Ross Hamer.
Ressler, Harvey Elwood,	Martinsburg,	Pa.	Chas. H. Clark.
Rich, Benj. Howard,	Bellefonte,	Pa.	W. C. Keplinger & Co.
Richardson, James,	Pickering,	Canada,	Geo. Y. Wood.
Ringer, Lewis Johnson,	Hagerstown,	Md.	M. L. Byers.
Rinker, Henry Paul,	Hellertown,	Pa.	C. W. Albright.
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Ritz, Chas. August,	Ashland,	Pa.	A. Schoenenberger.
Robbins, Edward Cruise,	Glassboro,	N. J.	F. G. Thomas.
Robert, De Wilton Smith,	Norristown,	Pa.	O. F. Lenhardt.
Rolland, Geo. Hegarty,	Edinburgh,	Scotland,	E. F. Backmann, M.D.
Rose, Frank,	Philadelphia,	Pa.	G. W. Brown, M.D.
Ross, Annie Catherine,	Philadelphia,	Pa.	W. E. Supplee.
Rowe, Thos. Maurer,	Reading,	Pa.	B. A. Hertsch.

Name.	*Place.*	*State.*	*Preceptor.*
Rutherford, John Burton,	Philadelphia,	Pa.	Chas. A. Rutherford.
Sausser, Howard Elmer,	Schuylkill Haven,	Pa.	John B. Raser.
Schaffer, Chas. Abraham,	Berlinsville,	Pa.	J. A. Weigner.
Schembs, Peter Joseph,	Philadelphia,	Pa.	C. E. Hewitt, M.D.
Scheuhing, John B.,	Shenandoah,	Pa.	F. W. E. Stedem.
Schlauch, Theodore Storb,	New Holland,	Pa.	Chas. J. Sether.
Scott, Thornton, T. B.,	Philadelphia,	Pa.	J. R. Smyser.
Sechler, LeRoy Rote,	Danville,	Pa.	Arthur S. Hollopeter.
Seiberling, Jos. D ,	Hynemanville,	Pa.	Frank Morse.
Seubert, Chas. Aloysius,	Lebanon,	Pa.	John F. Loehle.
Shafer, Wm. Addison,	Montoursville,	Pa.	E. C. Shafer.
Shaw, John Thomas,	Philadelphia,	Pa.	Joseph Crawford.
Sheehan, Wm. Henry,	Philadelphia,	Pa.	Harry M. Campbell.
Sheetz, Horace Eban,	Philadelphia,	Pa.	F. J. Voss, M.D.
Sheitz, Lloyd A.,	York,	Pa.	Harry A. Hay.
Shemp, Russell Nicholas,	Philadelphia,	Pa.	W. E. Supplee & Bro.
Shwab, Geo. Augustus,	Nashville,	Tenn.	
Sieber, Isaac Grafton,	Harrisburg,	Pa.	J. Wilson Hoffa.
Slobodkin, Rose,	Minsk,	Russia,	Susan Hayhurst, M.D.
Smiley, Geo. Washington,	Philadelphia,	Pa.	E. R. Smiley, M.D.
Smiley, Laura Marguerite,	Philadelphia,	Pa.	E. R. Smiley, M D.
Smith, Alfred Logan,	Smyrna,	Del.	Wm. F. Dunn.
Smith, Benjamin James,	Trenton,	N. J.	James Hinkley.
Smith, Cyrus Edward,	Philadelphia,	Pa.	H. A. Smith.
Snavely, Clarence Osborne,	Lebanon,	Pa.	Wm. G. Shugar.
Snyder, Harry Lamar,	Annandale,	N. J.	A. Spengler.
Snyder, John Paul,	Lancaster,	Pa.	W. T. Hock.
Sprout, Warren Austin,	S. Williamsport,	Pa.	J. Paul Suess.
Spurr, Thos. Andrew,	St. Clair,	Pa.	Milton S. Apple.
Stackhouse, Joseph Albert,	Bristol,	Pa.	Jesse W. Pechin.
Steinmetz, Wm. Baer,	Ephrata,	Pa.	G. S. Royer.
Stevens, Zebedee,	Philadelphia,	Pa.	A. B. Kennedy.
Stillwagon, Oscar Hulet,	Ambler,	Pa.	Jos. S. Angeny, Jr.
Stimus, Howard Geo.,	Moorestown,	N. J.	G. H. Wilkinson.
Stokien, Francis Joseph,	Charleston,	S. C.	
Stott, Horatio Allen,	Coatesville,	Pa.	W. S. Young.
Strawinski, Jacob Frank,	York,	Pa.	Dale, Hart & Co.
Swartley, Harry Mahlon,	Philadelphia,	Pa.	F. P. Streeper,
Swartz, Stanley Benjamin,	Park Place,	Pa.	John A. Weaver.
Swinehart, Daniel Harris,	Pottstown,	Pa.	L. L. Shuler.
Taylor, Howard Walter,	Clifton Heights,	Pa.	J. J. McFadden.
Thomas, Frank Hartwell,	Valdosta,	Ga.	
Thompson, Henry Kirk,	Titusville,	Pa.	E. K. Thompson & Son.
Thompson, Harry Merrill,	Selin's Grove,	Pa.	J. M. Wallis, M.D.
Thornton, Michael Thos.,	Ashland,	Pa.	J. A. Antill, M.D.
Tomlinson, Geo. Walton,	Rydal,	Pa.	S. T. Hamberg.
Townsend, Wm. Sidney,	Pocomoke City,	Md.	H. N. Willis, M.D.
Troth, Ernest Augustine,	Palmyra,	N. J.	Shoemaker & Busch.
Troxell, John Isaac Peter,	Allentown,	Pa.	I. E. Bennett, M.D.
Tucker, Stephen Allan,	Pembrooke,	Ontario,	Special Chemistry.
Twist, Oliver.	Trenton,	N. J.	Oscar Davison.
Tyler, Wm. Walston,	Onancock,	Va.	Geo. B. Evans.
Underwood, James Harris,	Woodbury,	N. J.	H. M. Brennan.
Waldner, Herman Theodore,	Ashland,	Pa.	Theo. H. Strouse.
Walter, Wm. Bell,	Gettysburg,	Pa.	H. C. Blair.
Watson, Joseph Shaffer,	Mt. Holly,	N. J.	W. F. Simes' Son.
Wells, Raymond Reid,	Columbus,	N. J.	A. N. Dobbins.
Wenrich, Wm. Paul,	Edgehill,	Pa.	W. E. Donough, M.D.
White, Wm. Clements,	Crawfordsville,	Ind.	Wm. F. Lytle.

Name.	*Place.*	*State.*	*Preceptor.*
Wild, Geo.,	Johnstown,	Pa.	Special Chemistry.
Wilson, Albert Emory,	Washington Borough,	Pa.	T. R. Gossling.
Wilt, Geo. Washington, Jr.,	Flemingsburgh,	Ky.	John J. Reynolds.
Winkler, Oscar Chas.,	Philadelphia,	Pa.	Christian Weiss.
Winslow, John Hayes,	Vineland,	N. J.	A. C. Taylor.
Wiseman, Walter Harry,	Philadelphia,	Pa.	E. A. Perrenot.
Wismer, Isaac Gross,	Philadelphia,	Pa.	E. T. Spencer.
Wiza, Joseph Louis,	Philadelphia,	Pa.	A. A. Poehner.
Wood, Jonathan Howard,	Norristown,	Pa.	McClure, Heritage & Co.
Wooten, Frank Marion,	La Grange,	N. C.	G. L. Wooten.
Wright, Joseph,	Easton,	Md.	Dawson & Jenkins.
Yates, John Julius, Jr.,	Wilmington,	Del.	H. K. Watson.
Young, Asa Harvey,	Easton,	Pa.	Mebus & Richards.
Zane, Wm. Spence, Jr.,	Seabright,	N. J.	Geo. B. Minton.
Zimmerman, Thos. Edward,	Carlisle,	Pa.	D. F. Emrick.

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Bahe, Wm. F.,	Chicago,	Ill.	W. A. Brabrook.
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Beckett, Josiah Bee,	Woodbury,	N. J.	A. S. Marshall.
Beeler, Aaron Wilson,	Mt. Eaton,	O.	A. W. Blackburn.
Bensinger, Geo. Irvin,	Schuylkill Haven,	Pa.	C. S. Commings.
Berg, David,	Philadelphia,	Pa.	Special Chemistry.
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Bode, Theodore Christian,	Atchison,	Kans.	M. Noll.
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Boyer, John Clinton,	Loyalton,	Pa.	H. C. Eddy.
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Brown, Roscoe James,	Oxford,	Pa.	E. E. DeGrofft, M.D.
Brugler, Elmer Geo.,	Bloomsburg,	Pa.	H. C. Blair.
Buehler, David Alexander,	Gettysburg,	Pa.	L. M. Buehler.
Buss, Marcus,	S. Bethlehem,	Pa.	M. M. Buss.
Cameron, Chas. Sherwood,	Rising Sun,	Md.	L. R. Kirk, M.D.
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Chalfant, Chas. Joshua,	Unionville,	Pa.	E. D. MacNair & Bro.

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Clair, Joseph Sylvester,	Pointville,	N. J.	J. L. Curry.
Clapp, Sam'l Clarence, Jr.,	Milton,	Pa.	C. E. Stout.
Clark, Edward,	Reading,	Pa.	F. X. Wolf.
Cloud, Norman Henderson,	West Chester,	Pa.	Luther Gerhard.
Codori, Simon Jacob, Jr.,	Gettysburg,	Pa.	J. M. Hillan.
Coller, Wm. Warner,	Reading,	Pa.	W. F. Potteiger.
Collings, Walter Nagle,	Philadelphia,	Pa.	Special Chemistry.
Collins, John Hall,	Philadelphia,	Pa.	R. C. Cadmus.
Comber, David Joseph,	Philadelphia,	Pa.	Joseph Healy.
Conover, Arthur Bruce,	Dayton,	Ohio,	C. H. Breidenbach.
Cooper, Morris,	Fredericksburg,	Pa.	J. H. Garman.
Cope, Edward Kreidler,	Philadelphia,	Pa.	F. H. Cope.
Corne l, Horace Hogeland,	Newtown,	Pa.	Robert Glenk.
Craig, James,	Glasgow,	Scotland,	F. H. Davis.
Craig, Ralph Butz,	Allentown,	Pa.	F. F. Thomson.
Crayton, Frank Blair,	Anderson,	S. C.	Simpson & Son.
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Davis, John Ellsworth,	Salem,	N. J.	W. H. Dunn.
Deane, Chas. Howard,	Wilmington,	Del.	J. M. Harvey.
Deemer, Geo. Morton Hays,	Greensburg,	Pa.	J. V. Stephenson.
De Graffe, Bertha Leon,	Albany,	N. Y.	Otto deKieffer.
Deibert, Wm. Henry,	Northampton,	Pa.	J. H. Stermer.
Dewees, Wm. Holstein,	Philadelphia,	Pa.	McClure, Heritage & Co.
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Dietrich, Pierce Abbott,	Kutztown,	Pa.	A. S. Butz, M.D.
Dill, Benjamin,	Philadelphia,	Pa.	W. E. Lee.
Draper, Oscar Carman,	Wilmington,	Del.	W. C. Taylor.
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Ehman, Joseph Wm.,	Williamsport,	Pa.	S T. Hamberg.
Elliott, Boyce,	Winnsboro,	S. C.	W. E. Aikin, M.D.
Elliott, James Troxell,	Gettysburg,	Pa.	J. M. Huber.
Eschbach, Clarence Derbie,	Milton,	Pa.	J. S. Follmer.
Failing, Wm. Clark,	Palatine Bridge,	Pa.	H. C. Blair.
Farley, Levi James,	Chester,	Pa.	Wm. H. Farley.
Farrell, Martin Edward,	Centralia,	Pa.	W. H. Read, M.D.
Felker, Harry,	S. Bethlehem,	Pa.	W. B. Gleim.
Few, Colin Spangler,	Middletown,	Pa.	J. D. McFerren.
Field, Claud,	Indianapolis,	Ind.	Special Chemistry.
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Flenniken, John Byron,	Uniontown,	Pa.	Frank Huston.
Flitcraft, Warren Whitney,	Woodstown,	N. J.	Special Chemistry.
Fluck, Franklin Wilson,	Allentown,	Pa.	Peters & Smith.
Freeman, Josiah Kisterboch,	Philadelphia,	Pa.	Rush P. Marshall.
Gabriel, Robert Rudolph,	Philadelphia,	Pa.	D. H. Ross.
Garcia, Juan Reyes,	Porto Rico,	W. I.	R. C. Martin.
Geiger, Walter Sam'l,	Reading,	Pa.	J. C. Griesemer.
Genz, Geo. Leonard,	Hazel Green,	Wis.	T. McNeill.
Gessford, Otice Eugene,	Lippincott,	Pa.	Funk & Groff.
Godfrey, Swain Townsend,	Seaville,	N. J.	Geo. J. Pechin.
Goldsmith, Lee,	Philadelphia,	Pa.	Harry Weiss & Co.
Good, Robert Franklin,	Allentown,	Pa.	J. C. Biddle.
Goodfellow, Chas. Rumney,	Philadelphia,	Pa.	E. M. Wallington & Co.
Gowen, Clarence Blain,	Brunswick,	Ga.	Special Chemistry.
Graham, Harry Edgar,	Chambersburg,	Pa.	J. S. Barnitz.
Greer, Mary Caroline,	Darby,	Pa.	H. M. Richardson, M.D.
Gross, Paul Herbert,	York,	Pa.	R. Wm. Ziegler.

Name.	*Place.*	*State.*	*Preceptor.*
Haines, Chas. Henry,	Rising Sun,	Md.	Theo. Campbell.
Hall, Robert Carson,	Kane,	Pa.	J. B. Cochran & Co.
Hamilton, Wm. Hamsher,	Shippensburg,	Pa.	J. C. Attick & Co.
Hance, Geo. Headley,	Philadelphia,	Pa.	H. A. Hance.
Hannan, Frank Wm.,	Johnstown,	Pa.	Chas. Griffith.
Harlow, Chas. Mills,	Wyncote,	Pa.	F. W. Brown Co.
Harmon, Geo. Alvin,	Machiasport,	Me.	C. Longfellow.
Harrell, Herbert Dean,	Wheeling,	W. Va.	Geo. H Ebeling.
Harris, Clarence Mulford,	Bridgeton,	N. J.	C. S. Ogden.
Harry, Hamilton Maxwell,	Conshohocken,	Pa.	James W. Harry.
Haymaker, Milo Miller,	Warrensburg,	Mo.	H. L. Barber.
Hayman, Walter,	Turbotville,	Pa.	Chas. L. Lashelle, M.D.
Heckerman, Adam Bruce,	Bedford,	Pa.	M. P. Heckerman.
Heffner, Edgar Franklin,	Centralia,	Pa.	Chas. L. Lashelle, M.D.
Heim, Christian,	Philadelphia,	Pa.	Henry Mueller.
Heinbach, Frank Walton,	St. Clair,	Pa.	J. L. D. Morison, M.D.
Helfrich, Edward Daniel,	Galion,	O.	H. G. Hackedorn.
Hellyer, Edwin Fayette,	Penns Park,	Pa.	James Huston.
Hendrickson, Wm. Randolph,	Swedesboro,	N. J.	H. E. Jones.
Herbert, Wm. Chas.,	Millstadt,	Ill.	Fred. Rose, M.D.
Herzog, Albert,	Washington,	Mo.	E. W. Gallenkamp.
Hiffmeyer, Wm. Joseph,	York,	Pa.	Wm. Smith & Co.
Hildebrand, Howard Ovid,	York,	Pa.	A. H. Lafean & Bro.
Hill, Wm. Maurice,	Lansford,	Pa.	Wm. M. Hill.
Hippler, Harry Richmond,	Philadelphia,	Pa.	W. C. Bichy.
Hodil, Frank Dilworth,	Sligo,	Pa.	J. R. Murray.
Hoffman, Wm. Shalter,	Danville,	Pa.	Geo. C. Devine, M.D.
Holt, James Stephen,	Philadelphia,	Pa.	J. D. McFerren.
Hörst, Harry Lewis,	Lock Haven,	Pa.	T. C. Hilton & Co.
Howell, Harry Field,	Easton,	Pa.	Geo. B. Evans.
Hukill, Oscar K.,	Hot Springs,	Ark.	Andrew Blair.
Humpton, Albert Norton,	Philadelphia,	Pa.	H. G. Kalmbach.
Hundertmark, John Chas.,	Cleveland,	O.	Acker Bros.
Hunt, Warren Ernest,	Philadelphia,	Pa.	J. C. Perry.
Ink, Chas. Thos.,	Columbiana,	O.	Chas. E. Ink.
Jackson, Thos.,	Philadelphia,	Pa.	L. W. Hildenbrand, M.D.
Jacoby, Chas. Nicholas,	Fond du Lac,	Wis.	J. T. Dana.
Jacoby, Wm. Lawless,	Philadelphia,	Pa.	Bullock & Crenshaw.
James, Robert Rosser,	Scranton,	Pa.	C. R. Shryer.
Janisch, Fred. Wm.,	Philadelphia,	Pa.	E. Jungmann.
Jennings, Isaac Astor,	Philadelphia,	Pa.	
Johns, Frank James,	Pleasant Mount,	Pa.	W. P. Wingender, M.D.
Johnson, Albert Burtis,	Point Pleasant,	N. J.	S. L. Carroll.
Johnson, Charlton Graham,	Columbus,	Ga.	Evans & Howard.
Johnson, Olive Curtis,	Danville,	Pa.	S. Y. Thompson, M.D.
Jones, Lester David,	Manchester,	Ia.	Wm. Procter, Jr. Co.
Kaye, Emma Louisa,	Philadelphia,	Pa.	John Kaye, M.D.
Kelchner, Charles Eber,	Bloomsburg,	Pa.	Geo. P. Ringler.
Kelley, Alfred Logan,	Wilmington,	Del.	Garrett S. Smith.
Kessler, Lawrence Anthony,	Logan,	O.	E. F. Kessler.
Ketterer, Martin,	Philadelphia,	Pa.	Max Sonntag.
Killiam, Wm. Smith,	Wilmington,	Del.	N. B. Danforth.
Kirlin, Chas. Coleman Hagenbach,	Shenandoah,	Pa.	P. P. D. Kirlin.
Kline, Frank,	Reading,	Pa.	A. Schaich.
Knoefel, Arthur Eugene,	Louisville,	Ky.	Knoefel & Knoefel.
Koehler, George,	Philadelphia,	Pa.	E. F. Koempfer.
Kramer, Geo. Henry,	Philadelphia,	Pa.	Robert McNeil.
Kunz, Chas. Cornelius,	Philadelphia,	Pa.	P. P. Klopp.
Kupfer, John Harry Joseph,	Butte City,	Mont.	C. W. Newton, M.D.

Name.	*Place.*	*State.*	*Preceptor.*
Lachenmayer, Henry Julius,	Philadelphia,	Pa.	Robert Shoemaker & Co.
Laughlin, Albert Russell,	Newville,	Pa.	B. F. Emrick.
Laucks, Wm. Irwin,	Upper Bern,	Pa.	Warren H. Poley.
Lautenbacher, Wm. Roth,	Tamaqua,	Pa.	
Lee, Henry Francis,	Port Kennedy,	Pa.	Funk & Groff.
Leech, David Malcolm,	Philadelphia,	Pa.	George Freshell.
Lenhart, Enos Samuel,	Philadelphia,	Pa.	G. L. Carnan.
Le Sage, George Lewis,	Fulton,	N. Y.	Wm. Wilson.
Leslie, Harry Carter,	Susquehanna,	Pa.	H. E. Outwater.
Levan, Walter,	Numidia,	Pa.	J. E. Gregory.
Lewis, Daniel Wm.,	Vineland,	N. J.	Wm. H. Faunce.
Lewis, Howard Hornberger,	Reading,	Pa.	G. L. Dengler.
Light, James Raymond,	Lebanon,	Pa.	Geo. W. Schools.
Lincoln, Geo. Washington,	Philadelphia,	Pa.	H. G. Shinn.
Littlefield, Bradford Allen,	Watertown,	N. Y.	E. C. Van Namee.
Lloyd, Ephraim Augustus,	Wilmington,	Del.	A. D. Cuskaden, M.D.
Long, Harvey,	Middletown,	Pa.	W. A. Burns, M.D.
Longmire, Chas. Henry,	Philadelphia,	Pa.	F. P. Reidenauer.
Luhr, Frederick A.,	St. Mary's,	Pa.	A. Millhaupt, M.D.
Lukens, Chas. Baker,	Philadelphia,	Pa.	D. A. Over.
McCracken, James Henry,	Darby,	Pa.	Harlan Cloud.
McGehee, Hanford Bell,	Staunton,	Va.	Lawson C. Funk.
McHenry, Walter Greenleaf,	Philadelphia,	Pa.	Aquila Hoch.
McLaughlin, Chas. Bishop,	Millville,	N. J.	A. H. Lippincott, M.D.
McNeil, Thos. Hunter,	Philadelphia.	Pa.	R. C. McNeil.
Maples, Murff Ford,	Pueblo,	Col.	A. C. Daniels.
Marshall, Chas. Gross,	West Fairview,	Pa.	R. C. Marshall, M.D.
Matusdow, Harry,	Minsk,	Russia,	C. H. Bohn.
Meier, August Joseph,	Aldenburg,	Germany,	G. J. Crumbie.
Meredith, Chas. Howard,	Media,	Pa.	Wm. E. Dickeson.
Metz, Abram Lehman,	Chambersburg,	Pa.	C. B. Lowe, M.D.
Metzler, Claude Dallas,	Harrisonville,	Pa.	Jas. A. Ferguson.
Meyers, George Henry,	Bryansville,	Pa.	H. F. Backenstoe.
Miller, Chas. Glanz,	Easton,	Pa.	George B. Evans.
Miller, James Augustus,	Eddyville,	Ia.	W. A. Alexander.
Miller, John Henry,	Ephrata,	Pa.	Alonzo Robbins.
Montgomery, John Custis,	Chambersburg,	Pa.	P. B. White.
Moore, Geo. Cooper,	Felton,	Del.	J. V. Slaughter.
Morgan, Clayton Edward,	Philadelphia,	Pa.	Frank E. Morgan.
Mosebach, Ferdinand Adam,	Bethlehem,	Pa.	G. H. Ochse.
Mountaine, Wm. Lewis,	Bangor,	Me.	L. L. Alden & Co.
Mueller, Chas. August,	Philadelphia,	Pa.	A. G. Keller.
Musselman, John,	Strasburg,	Pa.	R. W. Cuthbert.
Nailor, Elmer Byard,	Wilmington,	Del.	W. E. Smith.
Nebel, Chas. Wm.,	Philadelphia,	Pa.	A. S. Hollopeter.
Neville, Wm.,	Conshohocken,	Pa.	
O'Donnel, David Howard,	York,	Pa.	B. S. Gilbert.
Page, Edward Lewars,	Lancaster,	Pa.	Shinn & Baer.
Parke, John Siter,	Philadelphia,	Pa.	Chas. H. Tatem.
Peiffer, Chas. Oscar,	Morton,	Pa.	A. R. Morton, M.D.
Pennell, Jerome Chester,	Bridgeton,	N. J.	J. S. Supplee.
Peterson, Walter Vickerstaff,	Philadelphia,	Pa.	C. W. Shull.
Phillips, Wm. Newton,	Zanesville,	Ohio,	H. Sunderland, M.D.
Pierce, Herman Judson,	Troy,	Pa.	R. F. Redington.
Pierson, Wm. Harry, Jr.,	Wilmington,	Del.	J. S. Beetem.
Pilgrim, John W.,	Bridgeton,	N. J.	A. W. Cochran.
Place, Chas. Ross,	Stroudsburg,	Pa.	Jos. M. Kerr.
Portser, Chas. Henry,	Saltsburg,	Pa.	H. C. Watt, M.D.
Post, Edward Meigs,	S. Seaville,	N. J.	A. S. Buchanan.

Name.	*Place.*	*State.*	*Preceptor.*
Praul, Walter Francis,	Philadelphia,	Pa.	J. H. Masholder.
Pulsifer, James Perlie,	Lakewood,	N. J.	Chas. A. Bye.
Punt, Arnold Anthony Joseph,	Philadelphia,	Pa.	W. H. Pile & Sons.
Reed, Arthur Benjamin,	Pillow,	Pa.	Thos. Hetherington.
Reese, John Bull,	Centralia,	Pa.	Geo. W. Davis.
Reeve, James Whitaker,	Philadelphia,	Pa.	N. Pennypacker.
Reid, Wm. Watts,	Halifax,	N. C.	John H. Baughman.
Reifsnyder, David Ernest,	N. Heidelberg,	Pa.	Wm. E. Donough, M.D.
Reilley, Isabella Buist,	Philadelphia,	Pa.	C. H. Gubbings, M.D.
Rewalt, Jay Wm.,	Middletown,	Pa.	J. W. Rewalt.
Richardson, Neafie,	Rio Grande,	N. J.	Geo. M. Conard, M.D.
Rieben, Ernest,	Philadelphia,	Pa.	Chas. A. Gill.
Roach, Chas. Peter,	Driftwood,	Pa.	Wm. H. Roach.
Robertson, Henry Edward, Jr.,	Philadelphia,	Pa.	Shinn & Baer.
Robinson, Raleigh,	Hatboro,	Pa.	W. Robinson, M.D.
Ross, Frank Budd,	Vincentown,	N. J.	F. S. Hilliard.
Roth, Francis John,	Lund,	Sweden,	H. B. Spackman.
Rovno, Pinkas,	Kieff,	Russia,	M. Lupin.
Rudy, Harry Robert,	Hagerstown,	Md.	D. C. Aughinbaugh.
Ryland, Geo. Bertram,	Grantsville,	Md.	J. B. Copeland.
Sager, Verner Edward,	North Bristol,	Ohio,	Andrew Blair.
Sallada, Hunter Albert,	Ashland,	Pa.	D. G. Potts.
Schabinger, Chas.,	Felton,	Del.	Wm. Harris.
Schad, Harry John,	Tamaqua,	Pa.	L. J. Steltzer.
Schaeffer, Otis Oliver,	Middletown,	Pa.	R. T. Blackwood.
Schindel, David Philip,	Hagerstown,	Md.	S. F. Schindel.
Schmalzriedt, Fred.,	Philadelphia,	Pa.	Wm. R. Warner & Co.
Schmieg, Joseph Alphonse,	Philadelphia,	Pa.	H. D. Stechter.
Schneider, Kingsley Clark Thompson,	Berea,	Ohio,	Noble & Stone.
Schnurman, Henry Samuel,	Allentown,	Pa.	G. W. Shoemaker & Co.
Schroeder, Johann Heinrich,	Bassum,	Germany,	Louis N. Bérubé.
Schumann, August Frank,	Philadelphia,	Pa.	P. G. A. Weber (dec'd).
Seipel, Harry Bertram,	Philadelphia,	Pa.	L. Seipel.
Sellers, Walter Spangler,	Chambersburg,	Pa.	Cressler & Keefer.
Semmel, Franklin Pierce, Jr.,	Lehighton,	Pa.	C. T. Horn, M.D.
Seyforth, Julius Fred.,	Leavenworth,	Kans.	Jas. F. Ross.
Sharp, Warren Reed,	West Chester,	Pa.	A. B. Hammond.
Sherwin, Robert Suthers,	Scranton,	Pa.	Chas. Henwood & Co.
Shreve, Alexander,	Wrightstown,	N. J.	Mackall Bros. & Flemer.
Simpler, Willard Eugene,	Williamsport,	Pa.	W. J. Jenks.
Smith, Justin Tone,	Windsor,	Vt.	W. A. Rumsey.
Smith, Paul,	New Berlin,	Pa.	Robert Shoemaker & Co.
Spath, Geo. Balthaser,	Dillsburg,	Pa.	H. W. Fisher.
Spotts, Albert Oyster,	Newport,	Pa.	T. E. Conard, M.D.
Stadelman, Herman R.,	Ardmore,	Pa.	H. M. Davis.
Stahel, Albert Wm.,	Roscobel,	Wis.	H. B. Morse.
Steadman, Merril Linn,	Mifflinburg,	Pa.	W. D. Heiser.
Stephens, Halsey DeForest,	Seaville,	N. J.	J. M. Ridge, M.D.
Stevens, Thos. Ray,	Bethlehem,	Ind.	Julian Fajans, M.D.
Stine, Howard F.,	Mt. Carmel,	Pa.	A. S. Jordan & Co.
Stommel, Henry Aloysius Jos.,	Doylestown,	Pa.	Edwin M. Boring.
Stout, Edward Clayton,	Quakertown,	Pa.	Geo. C. Devine, M.D.
Strayer, Otho O'Burn,	Beverly,	N. J.	A. W. Taylor, M.D.
Streeper, Austin,	Norristown,	Pa.	H. R. Stallman.
Stroup, Freeman Preston,	Rouseville,	Pa.	Wm. C. Tyler, M.D.
Stump, Adam Franklin Marshall,	Womelsdorf,	Pa.	H. G. Haring.
Swainbank, Chas. Miller,	Wilkes-Barre,	Pa.	H. H. Swainbank.
Taff, Samuel Milton,	Fayetteville,	Ark.	Chas. H. Clark.

Name.	*Place.*	*State.*	*Preceptor.*
Taggart, Geo. Cole,	Emporia,	Pa.	L. Taggart.
Test, Ellwood Allen,	Philadelphia,	Pa.	John H. Kerr.
Thompson, Alexander Peterson,	Philadelphia,	Pa.	A. Pairman.
Thrush, Morris Clayton,	Charlestown,	W. Va.	Light & Watson.
Tiefenbach, Jacob Fred.,	Easton,	Pa.	Dr. Sheets.
Toelke, Charles,	Philadelphia,	Pa.	Frank E. Morgan.
Towles, Therret Rankin,	Henderson,	Ky.	J. L. Baldauf.
Townsend, James Vaughan,	Atlantic City,	N. J.	H. B. Leeds.
Tyson, Warren Sunderland,	Norristown,	Pa.	Atwood Yeakle.
Wagner, Chas. Henry,	Ashland,	Pa.	A. Schoenenberger.
Waldner, Paul Jacob,	Philadelphia,	Pa.	Wm. Geo. Toplis.
Wasley, Fred. Stanley,	Shenandoah,	Pa.	H. Wasley.
Watkins, Mack McInnis,	Moss Point,	Miss.	O. Eastland.
Watson, Jonathan Ingham,	New Hope,	Pa.	W. K. Mattern, M.D.
Weber, Howard Elmer,	Mahanoy City,	Pa.	M. R. Stein.
Weida, Chas. Arthur,	Reading,	Pa.	John B. Raser.
Weiss, Hervey Beale,	Philadelphia,	Pa.	Bullock & Crenshaw.
Weiss, Wm. Erhard,	Canton,	O.	Fisher & Young.
Weitzel, Sue C.,	Greensburg,	Pa.	Susan Hayhurst, M.D.
Wells, James Ralston, Jr.,	Philadelphia,	Pa.	Bullock & Crenshaw.
Wentzler, Hartman Gotthard,	Muncy,	Pa.	Chas. Ouram.
Weston, Edythe,	Wilmington,	Del.	M. Reynolds.
Wetzel, Samuel,	Carlisle,	Pa.	W. F. Horn.
Whiteley, Joseph C.,	Philadelphia,	Pa.	Fred. Rapp.
Wild, Geo. Fred.,	Logansport,	Ind.	D. E. Pryor
Williamson, Thos. McGill,	Frederick,	Md.	J. A. Williamson.
Wilson, Oliver Fawcett,	Pittsburg,	Pa.	E. F. Kessler.
Winger, John Bowman,	Philadelphia,	Pa.	Wm. F. Hartzell.
Wissmann, Herman Bayard,	Philadelphia,	Pa.	H. T. Hayhurst.
Woltman, Enos Frederick,	York,	Pa.	B. S. Gilbert & Co.
Young, Ben Lee,	Huntsville,	Ala.	Wallace Procter.
Ziegler, John Clayton,	York,	Pa.	B. S. Gilbert.
Zullinger, Aaron Henry,	Chambersburg,	Pa.	Greenawalt Bros.